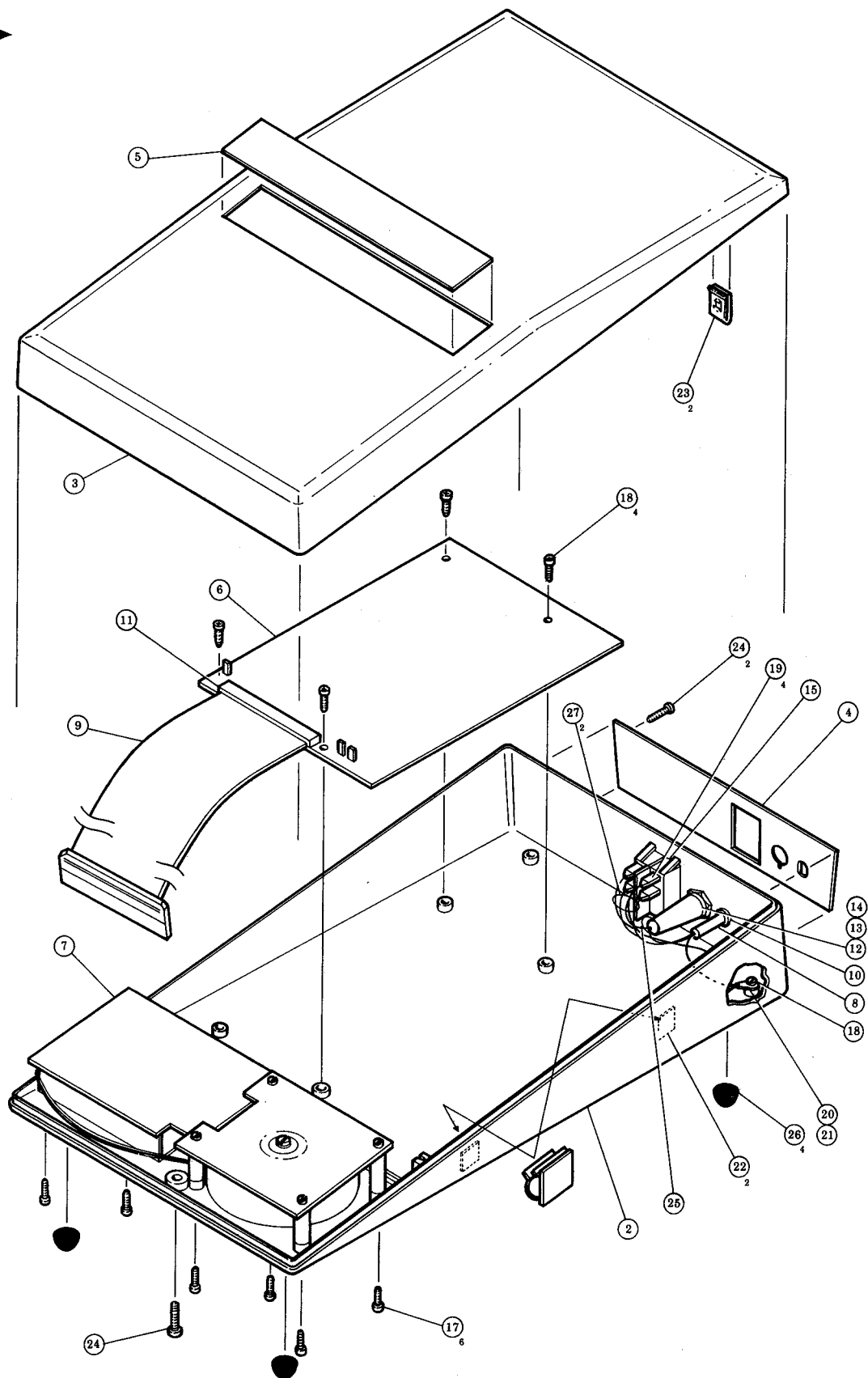
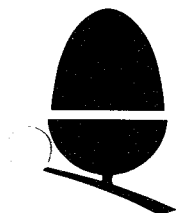




Z80 Second Processor General Assembly



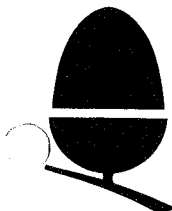
3.1 1MHZ BUS APPLICATION NOTE

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1. INTRODUCTION

The BBC Microcomputer has been designed to allow expansion in a number of ways. In addition to the specialised Disc and Printer plugs, there are three "general" expansion facilities. For these facilities, the Model B has IDC headers mounted at the front edge of the main board, accessed from the underside of the case.

The Tube interface and the user port will be discussed in other application notes. This note describes the signals available on the 1 Megahertz Bus, the circuitry required to utilise them, and the way in which they are connected to the Acorn Expansion Box. The expansion memory map is also defined. When interfacing designs to the 1MHz Bus, it is vital to ensure compatibility with Acorn standards, to prevent problems when using several pieces of equipment on the bus simultaneously.

Remember that the standards cover both hardware and software protocols.

It is as important for the software to follow these guidelines as it is for the hardware, otherwise simultaneous operations of several peripherals may not be possible.

The standards described allow up to 64K of paged address space to be accessed as well as 255 bytes of direct access ports.

2. SIGNAL DEFINITIONS

The following lines are available on the 1MHz Expansion Connector:

A0 - A7 (pins 27-34)	The low eight address lines from the 6502, buffered by a 74LS244 (IC 71) permanently enabled.
D0 - D7 (pins 18-25)	A bi-directional data bus connected to the CPU through IC 72, a 74LS245 buffer. The direction of data is determined by the system Read-not-write (R/W) line. The buffer is only enabled if NPGFC or NPGFD is low (see below).
Analogue In. (pin 16)	An input to the BBC Microcomputer audio circuitry. Input impedance is 9K ohms. A signal of +/-3volts RMS will produce a saturated signal at the loudspeaker (full volume), though signals this large will cause distortion if the on-board sound or speech is used at the same time.
NRST (pin 14)	Not Reset. This is an OUTPUT ONLY for the system reset line (active low). It may be used to initialise peripherals on power-up and when the "BREAK" key is pressed.
NPGFC & NPGFD (pins 10 & 12)	"Not page FC" and "Not page FD". Page select signals decoded from the top eight address bits of the system data bus. These signals are active low. Pages FC and FD (i.e. FC00 to FCFF and FD00 to FDFF hex) are the only pages available for general expansion. However, the paging register described in Section 5 allows a much larger address space to be accessed.

NIRQ (pin 8)

Not Interrupt Request (active low). The system IRQ line which is open collector (i.e. "wired-or") and may be asserted by devices attached to the extension bus. The pull-up resistor on this line is 3K3.

IRQ is level triggered and it is absolutely essential for correct operation of the machine that interrupts do not occur until the software is capable of dealing with them. Interrupts on the 1MHz bus should therefore be disabled on power-up and reset conditions. Significant use of interrupt service time may affect other machine functions. In particular, masking interrupts for more than 10ms will affect the real time clock.

NNMI (pin 6)

Not Non-Maskable Interrupt (active low). The system NMI line which is open collector (i.e. "wired-or") and may be asserted by devices attached to the extension bus.

The pull-up resistor on this line is also 3K3.

It should be remembered that NMI is negative edge triggered and that both the disc and net chips on the main board use this line. Caution must be exercised to avoid masking other interrupts by holding the line low. Use of NMI facilities on the BBC machine requires an advanced knowledge of 6502 programming techniques and the Operating System Protocols.

1 MHzE (pin 4)

A system clock timing signal which is a 1MHz 50% duty-cycle square wave. During access to 1MHz peripherals and to the extension bus the processor clock (normally 2MHz) is stretched so that the trailing edges of 1MHzE and processor clock are coincident.

R/W (pin 2)

The system Read-Not-Write signal which is derived from the CPU R/W signal through two 74LS04 inverters.

0V (pins 1,3,5,7,9,11,
13,15,17,26)

System 0V, i.e. GND wires, dispersed so as to interleave with asynchronous groups of signals in a flat ribbon cable.

3. HARDWARE REQUIREMENTS FOR 1 MHz EXPANSION BUS PERIPHERALS

1. No power may be drawn from the BBC Microcomputer. Each peripheral should have its own integral power supply, although a separate power unit may be used.
2. Not more than one low-power Schottky TTL load may be presented to any bus line by each peripheral.
3. A 1MHz Bus feed-through connector should be provided. Connection to the BBC Microcomputer should be via 600mm of 34-way ribbon cable terminated with a 34-way IDC socket, and fitted with strain relief. Please note that copying the Teletext Adapter's layout is not possible, because this has been given the special status of the last box in the chain.
4. Optional bus termination should be provided on all bus lines except NRST, NNMI and NIRQ. The recommended termination is a 2K2 resistor to +5V and a 2K2 resistor to ground for each line.
5. The timing requirements for the 1MHz Bus are detailed in Figure 1.

4. FURTHER REQUIREMENTS FOR EQUIPMENT TO BE APPROVED BY ACORN COMPUTERS

1. Address space within page &FC must be allocated by the Research and Development Department of Acorn Computers Ltd. - see Section 6.
2. The dimensions of any peripheral and its associated integral power supplies should allow it to be fitted into the BBC Microcomputer Expansion Box - see Figure 4.
3. When housed in the Expansion Box, the equipment should meet BS 415 Class 1 specifications for Electrical safety.

Further details of the requirements and procedures for gaining approval should be obtained from Acorn. The information included here is for guidance only and is not intended to be a full specification for approval.

5. DERIVATION OF VALID PAGE SIGNALS

1MHz peripherals are clocked by a 1MHz 50% duty cycle square wave (chosen to allow chips such as the 6522 to use their timing elements reliably). The BBC Microcomputer's c.p.u. normally operates with a 2MHz clock, but with a slow-down circuit which has the effect of stretching the "clock high" period immediately following the detection of a valid 1MHz peripheral address.

There are two problems as a result of this. First, addresses will change and may momentarily become 1MHz addresses while the 2MHz c.p.u. clock is low, but while the 1MHzE signal is high. This could give rise to a spurious pulse on the chip select. Second, if the c.p.u. deliberately addresses a 1MHz peripheral during the time that 1MHzE is high, the device will be addressed immediately, and then again when 1MHzE is next high: this is because the c.p.u. clock will be held "high" by the stretching circuit until the next coincident falling edge of the 1MHz and 2MHz clocks. See Figure 2: the two accesses are marked C and D. This double access is not usually a problem except when reading from or writing to a location twice has some additional effect: an example of this is an interrupt flag which is cleared by reading it.

These effects mean that the 1MHzE Bus cannot be used as a conventional "address valid" signal. However, addresses will always be valid on the rising edge of 1MHzE. If the chip select lines are latched by 1MHzE as shown in Figure 2, the clean signal CNGFC (or CNPGFD) will be generated.

6. ADDRESS SPACE ALLOCATION

PAGE FC

Page FC is reserved for peripherals with small memory requirements. Only one peripheral will be allocated to each group of addresses. Further allocations must be agreed with the R & D department of Acorn Computers Ltd.

Initial allocations are:

FC00 to FC0F	Test Hardware
FC10 to FC13	Teletext
FC14 to FC1F	Prestel
FC20 to FC27	IEEE 488 Interface
FC28 to FC2F	Acorn Expansion: Spare
FC30 to FC3F	Cambridge Ring Interface
FC40 to FC47	Winchester Disc Interface
FC48 to FC7F	Acorn Expansion: spare
FC80 to FC8F	Test Hardware
FC90 to FCBF	Acorn Expansion: spare
FCC0 to FCFE	User Applications
FCFF	Paging Register

PAGE FD

Page FD is used in conjunction with the paging register to provide a 64K address space, accessed one page at a time. Each BBC Expansion Box will have a paging register on the back plane, thus data will be latched simultaneously on every Expansion Box. Data latched into the paging register will provide the top eight address bits to the eurocard back plane. These top address bits are referred to as the 'Extended Page Number'. Any peripheral designed to locate in page FD without using an expansion back plane must latch and decode the paging address information.

To make this facility as easy to use as possible, NPGFD (a hazard-free version of the signal available from PL 12) will be connected to the back plane pin 24b, 'Not Valid Memory Address', and also OR-ed with the top four extended page address lines as a link selectable option to pin 31a 'BLK0'. (the other option on this pin will be NPGFC).

Extended pages &00 to &7F are reserved for Acorn use, pages &80 to &FF may be freely used by special applications. The paging register will be reset to &00 on power-up and BREAK.

Since the paging register is a write-only latch, location &00EE in the zero page of the BBC machine address map has been allocated as a RAM image of the register. Note that this location will remain in the I/O processor's memory map if a second processor is fitted.

The importance of this image is that it allows interrupt routines to change the paging register and restore it again afterwards.

It is vital to change location &00EE BEFORE changing the paging register itself. If you don't, then an interrupt may occur before you change the RAM image and this will restore the paging register to the old value of &EE.

A suitable sequence is

```
LDA # new value
STA &EE
STA &FCFF
```

MACHINE CODE

OR....

```
?&EE = new value
?&FCFF = new value
```

BASIC

User routines should save the contents of &EE before changing the paging register and restore both &EE and &FCFF to this value before returning from the interrupt.

A suitable sequence is

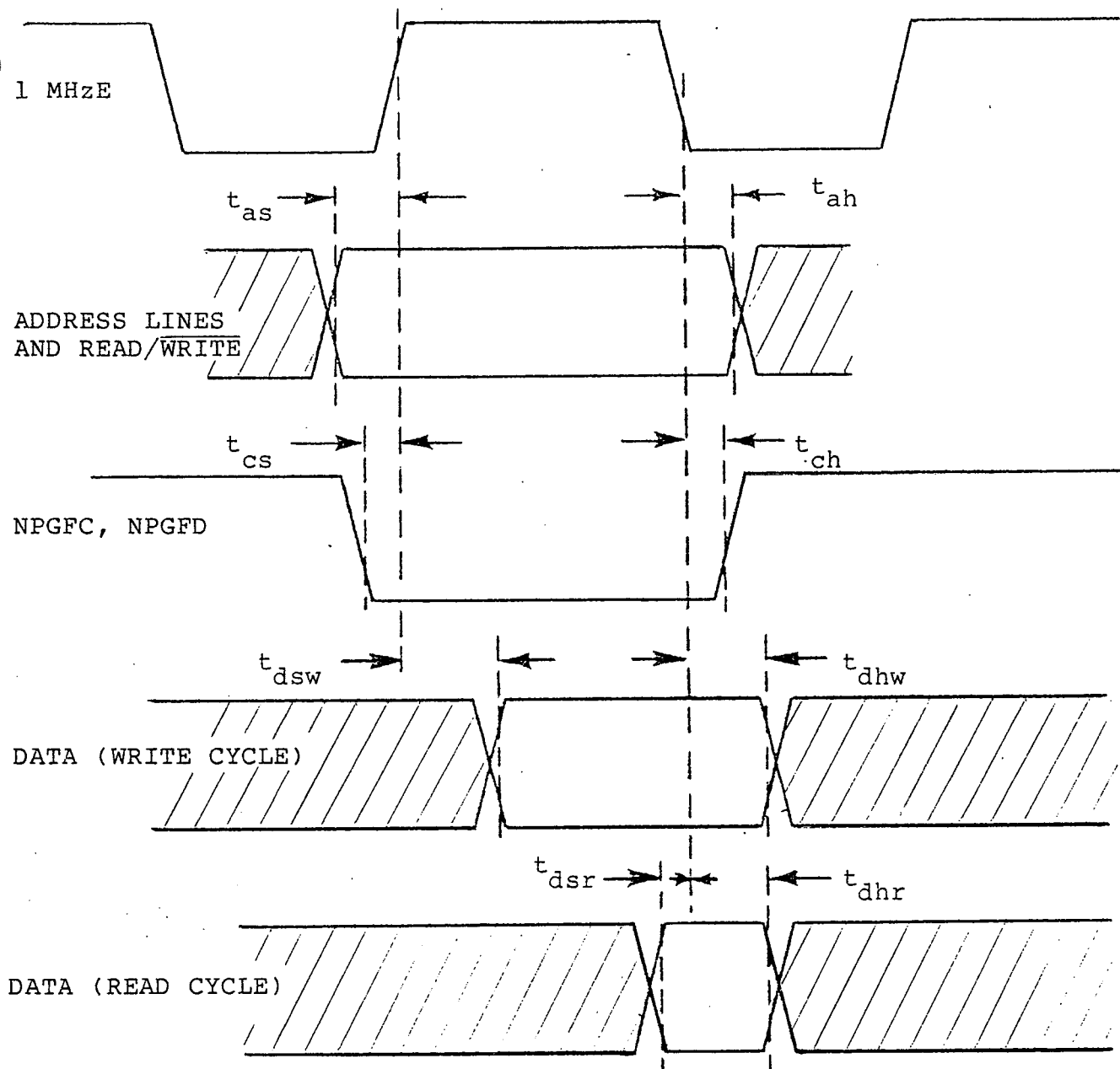
[save processor registers etc]

```
LDA &EE
STA tempstore
LDA # new value
STA &EE
STA &FCFF
```

[users code here]

```
STA &EE
STA &FCFF
```

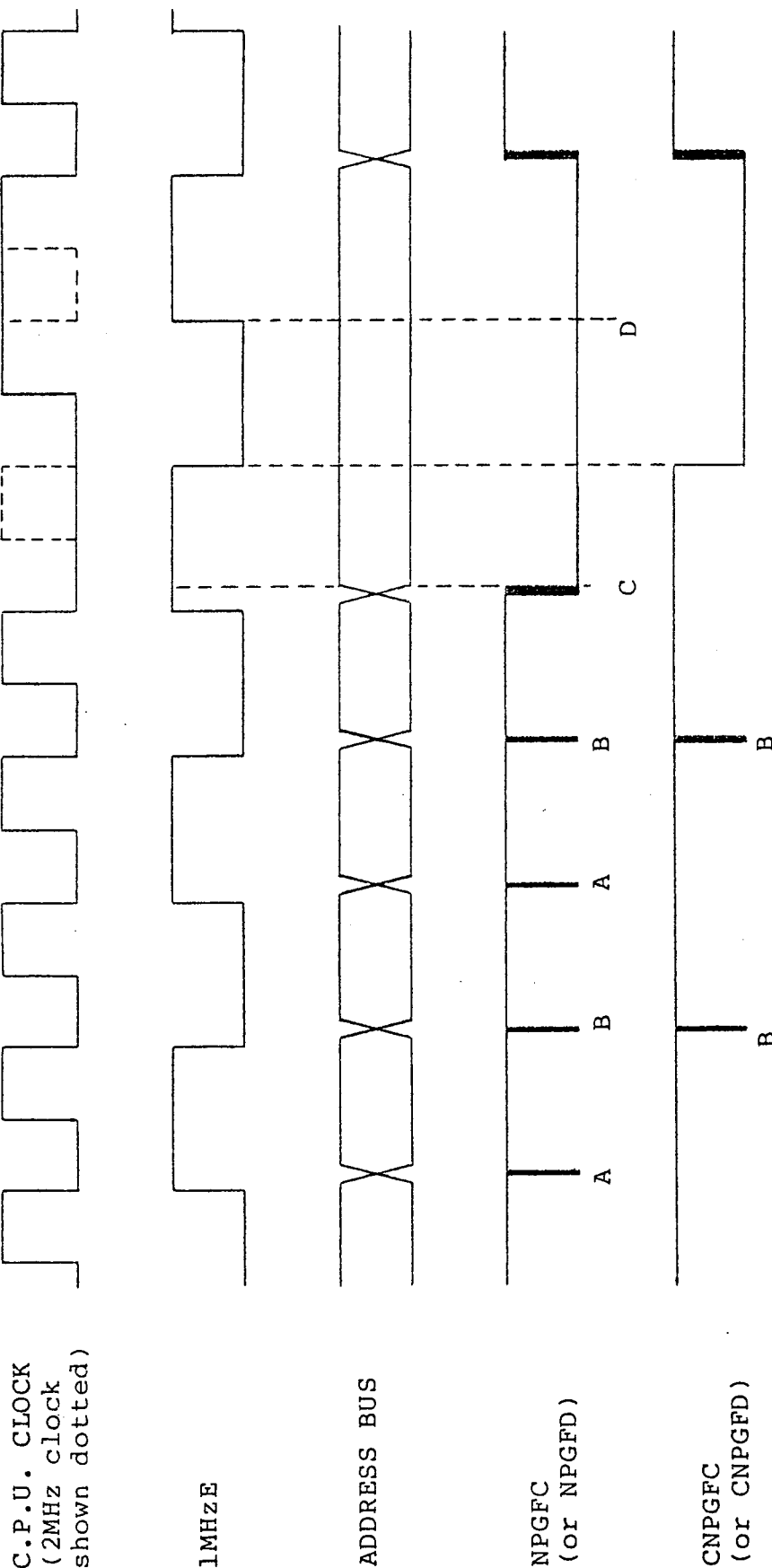
[restore other data and return]



Timing requirements

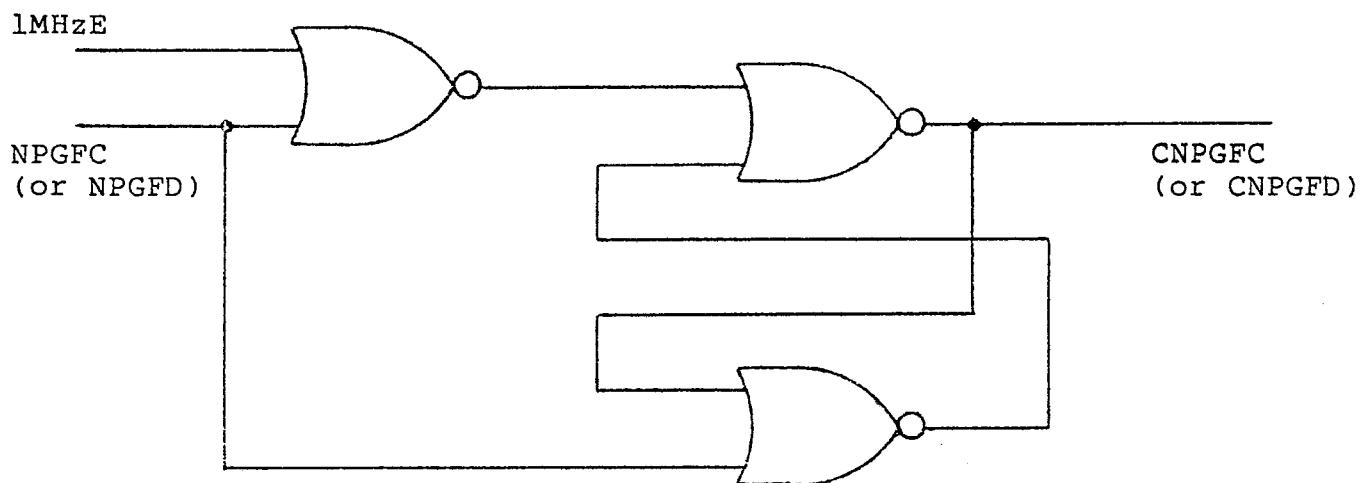
Parameter	Symbol	Min.	Max.
Address Set-up time (& R/W Set-up time)	t_{as}	300	1000
Address Hold Time (& R/W Hold Time)	t_{ah}	30	-
NPGFC & NPGFD Set-up Time	t_{cs}	250	1000
NPGFC & NPGFD Hold Time	t_{ch}	30	-
Write Data Set-up Time	t_{dsw}	-	150
Write Data Hold Time	t_{dhw}	50	-
Read Data Set-up Time	t_{dsr}	200	-
Read Data Hold Time	t_{dhr}	30	-

Note: The above timings are based on only one peripheral attached to the Expansion Bus. Heavy loading may slow the rise and fall times of 1MHzE with possible adverse effects on timings.



As the address lines settle, a momentary pulse could occur on the NPGFC (or NPGFD) line. The pulses at B are ignored because 1MHzE is low, but those at A could cause a spurious access. When a valid 1MHz device address appears, NPGFC (or NPGFD) goes low: this can happen as shown whilst 1MHzE goes high, accessing the device. When a 1MHz address is detected, the clock stretching circuit waits if necessary for the next rising edge of the 2MHz clock (point E), and holds the c.p.u. clock (point F). Hence the device is accessed again at point D, when 1MHzE is next high. The gated signal CNPGFC (or CNPGFD) removes the glitches A and the first of the two accesses at C.

F I G U R E 2 DERIVATION OF VALID PAGE SELECT SIGNAL



R-S flip-flop with gated input which allows 'clean select' to be set low only if 1MHzE is low. An alternative circuit using transparent flip-flops is shown on the circuit diagram for the Expansion Box back plane (Drawing 107,000)

FIGURE 3 DERIVATION OF CLEAN SELECT SIGNALS

NOTE: All dimensions in millimetres

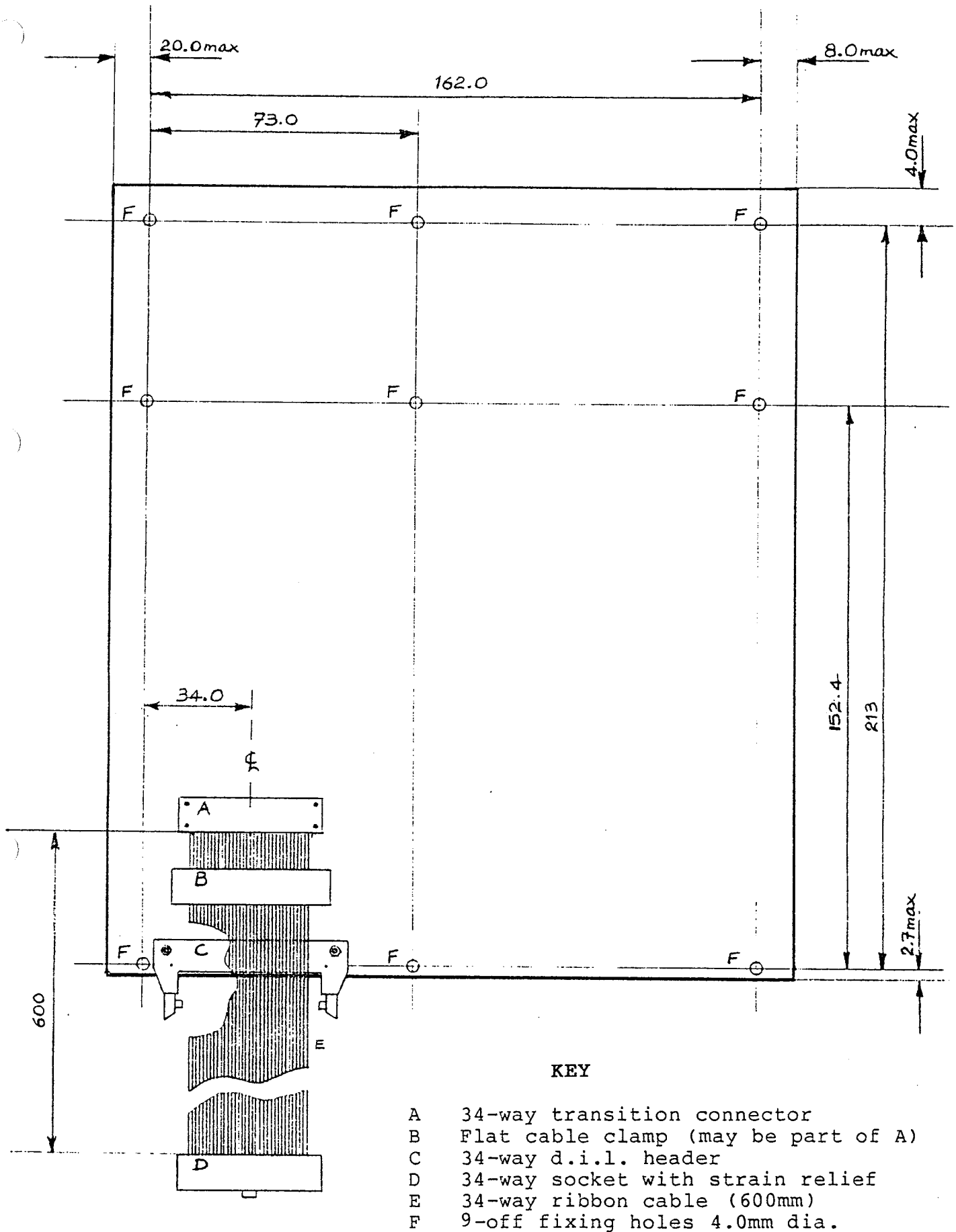
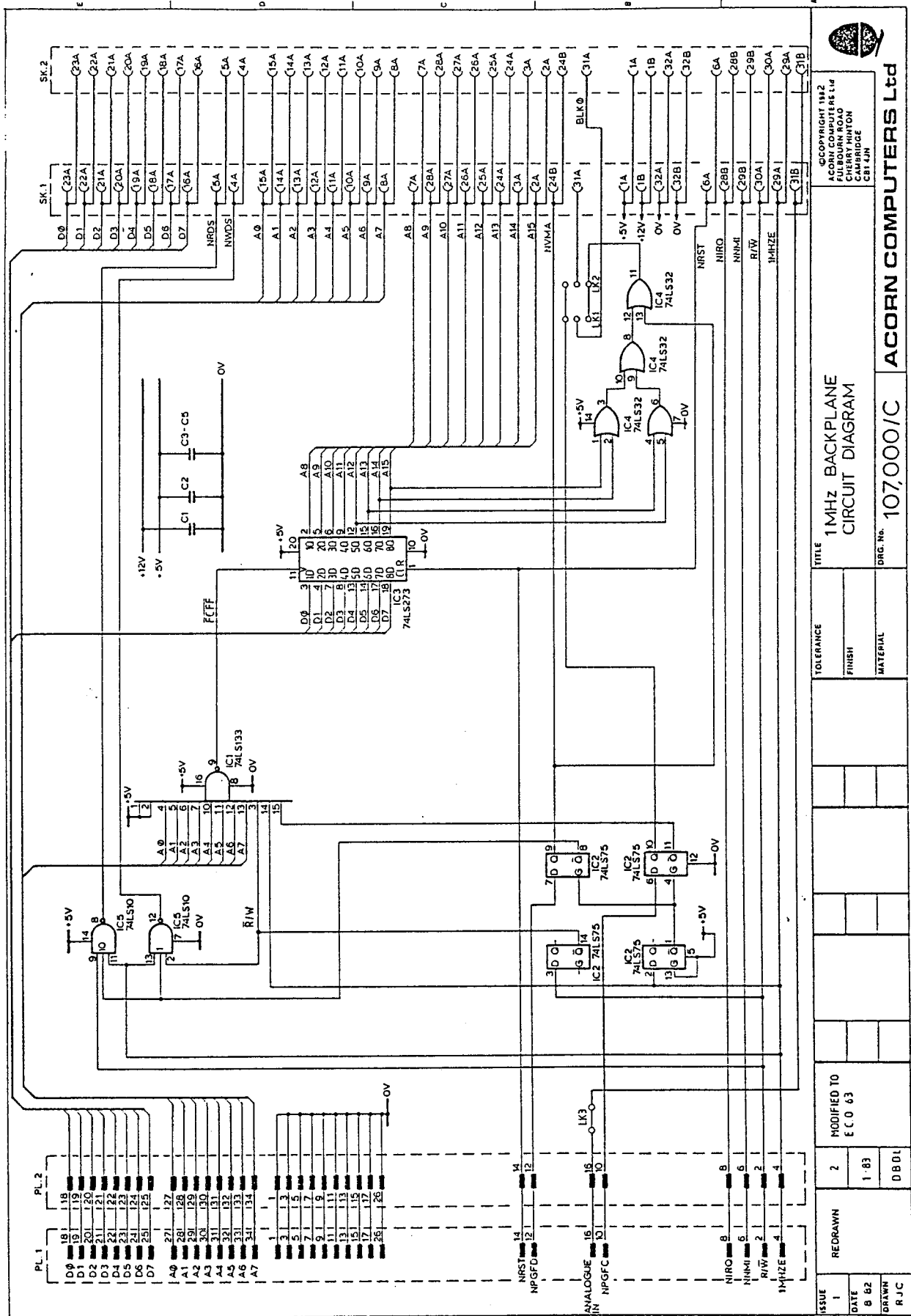


FIGURE 4

BOARD DIMENSIONS TO FIT
BBC MICROCOMPUTER EXPANSION BOX



ACORN COMPUTERS LTD
FULBURN ROAD
CHERRY HINTON
CAMBRIDGE
CB1 4JN

1MHz BACKPLANE CIRCUIT DIAGRAM

107000/C

ACORN COMPUTERS Ltd

TOLERANCE
FINISH
MATERIAL

ISSUE
1

REDRAWN
2

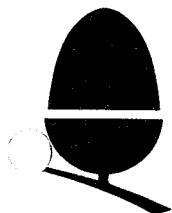
DATE
8 82

DRAWN
RJC

MODIFIED TO
ECO 63

1 83

0801



3.2 SIDEWAYS ROMs APPLICATION NOTE

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3	Service Sideways ROMs	4.3.2.6 4.3.2.7 4.3.2.8 4.3.2.9 4.3.2.10 4.3.2.11
4	Filing System ROMs	4.3.2.11 4.3.2.12 4.3.2.13

SIDEWAYS ROMS

1 Introduction

The BBC microcomputer can be configured to have up to 16K of software from &8000 to &BFFF paged in (i.e. present in the address space) under OS control. Up to 16 such 16K pages may be placed side by side in this location but only 4 sockets are available in the machine so extra hardware is required to use to full extent. Paged ROMs reside in ICs 52, 88, 100 and 101 on the main BBC PCB. These sockets can also accept EPROMs (type 2764, or 2732) if the appropriate links have been selected. The memory map in this region would appear as below:

ADDRESS				
	IC51 Operating System			
&C000				
	IC52	IC88	IC100	IC101
&8000				

The paged ROMs are ICs 52, 88, 100 and 101.

The first section of a paged ROM must conform to a specific format. ROMs that do not conform are ignored by the OS.

The required format is shown below:

OFFSET		SIZE
0	JMP (language)	3
3	JMP (service)	3
6	ROM type	1
7	Copyright offset pointer	1
8	Version number (binary)	1
9	Title string	[t]
	&00	1
	Version string	[v]
	&00	1
	'('	1
	'C'	1
	')'	1
	Copyright string	
	&00	1
	Rest of ROM . . .	

Note that the copyright offset pointer is relative to the start of the ROM and points to the zero before the '('.

Each field of the ROM format is described in the following sections.

1) JMP (language)

A three byte JMP instruction referring to the language entry point. This field should contain zeros if the ROM is not a language ROM.

2) JMP (service)

A three byte JMP instruction referring to the service entry point. This field should contain zeros if the ROM is not a service ROM.

3) ROM type

A byte identifying the type of code contained in the ROM.

```
-----
| S | L | 0 | K | 0 | 0 | 1 | 0 |
-----
```

S=1 => this is a service ROM
L=1 => this is a language ROM

A ROM may be both a language ROM and a service ROM.
All OS ROMs have S=0 and L=0.

K=1 => this language ROM supports soft key expansions on the Electron.

4) Copyright Offset pointer

A pointer relative to the beginning of the ROM pointing to the zeros after the version string.
It is important that this offset points to the four bytes '&00', '(', 'C', and ')' in order. This sequence is used by the OS to determine whether a physical ROM resides in a paged ROM socket.

5) Version number (binary)

A version number (in binary starting from zero) distinct from version numbers appearing in previous generations of ROM software. This byte need not have any correspondance with the version string.

6) Title string

A string identifying the ROM. This string is output by the OS when entering the ROM as a language ROM.

7) Version string

A string identifying the release number of the ROM software. The recommended format is A.BB, where A and B are decimal digits.

8) Copyright string

A string identifying the software house responsible for the ROM product. The recommended format is the year, followed by a space, followed by the name of the company.

When a language is entered the error report pointer is set to point to the zero byte preceeding the copyright string. (For example, in BASIC the REPORT command outputs the copyright string).

Rest of ROM

The program code itself.

2 Language sideways ROMs

Note that you may be wanting to write a language ROM even if you are not writing a language (!) - notable language ROMs include Text editors, Dumb terminal emulators, Teletext decoders, games, and other stand-alone application programs not requiring a language. Language ROMs are slurped across the 'TUBE' in a dual processor configuration and hence have access to all that wonderful memory on the other side. The penalty for this is that Languages must not make hardware dependant peeks & pokes. To get the best of both worlds, a ROM may be a hybrid, with a machine-independant 'language' section communicating with the sordid hardware poking code (which has service ROM status) by unallocated OSWORD calls.

The language entered on power up is the language in the paged ROM socket that is closest to the edge of the BBC microcomputer main PCB. The language entered after a BREAK is the language active at the time that BREAK was pressed. After a ctrl. BREAK, the language in the paged ROM closest to the edge of the PCB is entered again.

The language can be changed by typing the appropriate command (e.g. *BASIC or *PASCAL). This is recognised in the standard service ROM manner, and hence the service ROM bit must be set in the ROM header if the language is to be started in this way. Upon recognising the relevant *command from the service entry, OSBYTE should be called with A=&8E, X=<ROM no.> (The ROM no. is in X on entry and also in location &F4). Note that this OSBYTE call never returns, so there is not a lot of point in preserving registers, for example, hoping to restore them afterwards, as there is no afterwards! The rom will now be entered at the language entry point, and will also be re-entered after BREAK has been pressed (it is at this point that the perilous journey into the second processor is undertaken. Note that there is no processor type checking done so an NS16032 may be given the language contents of a standard sideways rom). On entry, A contains an entry code - see below.

On entry, language ROMs must enable IRQ interrupts, or the MOS will not work. For workspace, the language has available 1K from &400 to &800 plus the dynamically allocated memory from the 'OS high-water-mark' to the start of the currently selected screen mode (the screen start should be requested from the MOS by OSBYTE call, because this indicates that on TUBE systems the screen takes up no room at all, and on model As it comes down much further than on model Bs). The language is responsible for intercepting the BRK vector and handling BRKs to produce a sensible error response (this can be left out if the ROM is so simple that no errors can occur, but remember that even calling OSWRCH can cause an error if the spool file is full, for example).

Language Entry Codes

A=0 Entry to Tube code if no language present

A=1 Normal entry to start up language

A=2 Request next byte of soft key expansion (Key no. set by call with A=3, result in Y)

A=3 Request length of soft key expansion (Key No. in Y, result in Y)

Note that codes 2 & 3 are only used for ROMs required to run on the electron and will not be used on the BBC computer. These calls will only occur if bit 4 of the ROM type byte is set.

3 Service sideways ROMs

A service ROM may take several forms:

A filing system

An application package (e.g. CAD graphics)

An application program (e.g. joystick keyboard for the disabled).

Any filing system (e.g. disc) integrates into the OS via a service ROM interface (except the cassette filing system which is resident in the OS ROM). Thus the discussion for service ROMs applies to all filing systems other than the cassette.

When a service is 'offered' to service ROMs in turn, it is offered to ROMs from the edge of the PCB inwards. On offering the service, A will hold a reason code, X a ROM number and Y a parameter if applicable. The reason codes are tabulated below and then explained in more detail:

REASON CODE DESCRIPTION

00	NOP
01	Absolute space claim
02	Relative space claim
03	Bootstrap
04	Command, unknown to OS
05	Interrupt, unknown to OS
06	BRK
07	OSBYTE call, unknown to OS
08	OSWORD call, unknown to OS
09	*HELP
0A	Claim static work space
0B	NMI being released
0C	NMI request
0D	
0E	
0F	Vectors claimed
10	
11	

The OS offers some of these on power-up, the others at other times depending upon what the OS is called upon to do. After looking at the offer, each sideways ROM must restore the registers to their condition on entry to the ROM. If the ROM accepts the service then after processing, the ROM must return A=&00 so that the call is ignored by all other ROMs (A=&00 corresponds to no-operation, NOP).

REASON CODE=&00

This means the call has been claimed by someone else and therefore should be ignored.

REASON CODE=&01

Absolute space claim.

This service is offered on power-up, and lets the ROMs tell the OS how much work space they would require if called. Pages &E00 and above provide a fixed work area. On power-up, the sideways ROM code is called with A=&01, X = ROM number and Y = top of fixed area. If the top of the fixed area is not sufficient for the requirements of the code, then it should be increased, otherwise Y should be preserved.

REASON CODE=&02

Relative space claim.

This memory space is 'relative' because it follows on from the fixed area which has a variable upper boundary (depending upon the static work space requirements of the ROMs). Each sideways ROM has the opportunity on power-up to claim part of the relative area, which then becomes private to that ROM - hence also called private data area. The area for each ROM should be large enough to store all the data required to keep the context of the code during a dormant phase. At power-up the OS calls the ROM with A=&02, X = ROM number and Y = start page. If private space is required, Y should be incremented, the initial value being the start of the reserved area to be used. The first piece of code in a ROM should store this in the ROMnumbereth location of the 16 bytes from &0DF0 to &0DFF. Subsequent pieces of code should know their base addresses relative to this. Hence all code intended to be placed within a sideways ROM would include a definition for the offset from the start of the data area, and the necessary code to add it to the pointer.

REASON CODE=&03

Auto-boot.

Each service ROM is given the opportunity of auto-booting after the start-up message has been displayed (i.e. after power-up or BREAK). The ROM should test for a condition under which it might (a) be selected and (b) automatically load/execute/EXEC a file with name '!BOOT'. The service ROM should determine whether any key is pressed. If no key is pressed or a key unique the the service ROM

(e.g. 'D' for the DFS) is pressed then the ROM should select itself.

If the service ROM determines that it should not select itself then it should return without claiming.

If the filing system determines that it should select itself then it should auto-boot if it is entered with Y=0.

The exact interpretation of auto-boot is service ROM dependent.

REASON CODE=&04

Offers command line for interpretation.

When the user issues an OS command it is processed by the OS. The OS may recognise it, in which case the corresponding code will be executed. However, if the command is not recognised it is offered to the service ROMs. The unknown command is offered to each of the service ROMs in turn. A service ROM may either ignore the service, or claim the command, in which case the service will not be offered to other service ROMs.

It should be noted that only filing system independant commands should be intercepted or filing system selection commands; thus utilities may intercept here but filing systems may not.

Commands that should be intercepted - DISC,NET,BUILD,....

Commands that should not be intercepted - INFO,DELETE,....

ON ENTRY,

A has the value &04

X contains the ROM number.

Y Contains an offset, which combined with the pointer in zero page located at &00F2 points at the line to be processed (spaces and asterisks have been skipped).

ON EXIT, restore all the registers. Set A=&00 to prevent other service ROMs being offered the service.

If no service ROM claims the unknown command then the command is offered to the currently active filing system.

REASON CODE=&05

Unknown interrupt.

If an interrupt occurs which the OS does not recognise, it will offer it to the service ROMs. In such a case, A=&05, X = ROM number.

If a service ROM recognises the interrupt then it should accept the offer and process the interrupt accordingly. Afterwards it should return with A=&00 to prevent other service ROMs being offered the interrupt. N.B. You should return with an 'RTS' NOT an 'RTI'.

REASON CODE=&06

BREAK

Any BRK instruction causes this call before indirecting through <BRKVEC> at &0202. BRK's are used to signal errors.

REASON CODE=&07

Unknown OSBYTE call.

An OSBYTE call will normally be processed by the OS. If, however, the OS does not recognise the call it will pass it on to the service ROMs.

When an OSBYTE call is offered to the service ROMs, the A,X and Y registers (which initially hold parameters relevant to the OSBYTE call) are stored in locations &00EF thro' &00F1. The ROM should check that the call applies to it be checking location &00EF.

If a service ROM accepts the OSBYTE call, it should, after dealing with it, return A=&00 and the X and Y registers unchanged.

REASON CODE=&08

Unknown OSWORD call.

An OSWORD call is normally dealt with by the OS. However, if the OS does not recognise an OSWORD call then it will be offered to the service ROMs in a manner similar to unknown OSBYTE calls. The contents of A,X and Y (which point to the control block) are stored in locations &00EF thro' &00F1. The ROM should check that the call applies to it be checking location &00EF. Again, on accepting an offer, a service ROM should deal with the call and then return with A=&00 and the X and Y registers restored. It should be noted at OSWORDS > 127 are not really OSWORDS at all but pass through the user vector at &0200.

REASON CODE=&09

*HELP

When a *HELP command is intercepted by the MOS this call is initiated. The rest of the command line is pointed to by (&F2),Y in the standard manner. If the remainder of the line is blank then the name of the ROM followed by version number should be output and on subsequent lines any subheadings to which the ROM will respond. Thus the DFS outputs:

```
DFS n.nn
DFS
UTILS
```

Showing that it will respond to *HELP DFS and *HELP UTILS.

If the rest of the line is not blank then the ROM should compare it against its subheadings and if any of them match then it should output the info from under that subheading. Thus *HELP UTILS will produce:

```
DFS n.nn
BUILD <fsp>
```

DISC
DUMP <fsp>
LIST <fsp>
TYPE <fsp>

If there is more than one item on the line then the ROM should respond to all of them individually.

The following two reason codes may be used by a sideways ROM in conjunction with the OSBYTE call with A=&8F (the reason code being put in X). These calls should be used by a ROM when it is activated, to claim the static work space (reason code &0A) and/or the NMI area (reason code &0C) if these areas are required.

REASON CODE=&0A

Claim static workspace

When a sideways ROM is activated it may call OSBYTE with A=&8F, X=&0A and Y=&FF to claim the static workspace, the previous user will save any valuable contents in its private area. The work area is not returned after use - the next user simply claims it, and will only release it when asked by a new user starting up. When accepting a call from some other claimant, the variables in the fixed area which are required to maintain context should be written to some variable area. This may be in the private variable space, or in some secret place, such as the 1K of RAM on the teletext unit. At the same time, any scratch data should be marked as lost, or for random file buffers, written back to disc. On claiming this area, the zero page workspace is also available (&20 bytes). Variables in this area are lost in the same way as variables in the main area.

****note**** The claiming of workspace and the selection of filing system are totally independant, so you may have the workspace but not be selected as the filing system (eg if the cassette has been selected, which has its own workspace), or, far worse, be selected as the filing system but not have the workspace. To cope with this, you should have a flag (which must be in your private workspace !) to indicate whether you have the workspace. If you are entered in any way, you should check this flag, and if you find that you do not have the workspace, you should immediately grab it back. This is a pain to implement !!!! An easier (though undesirable) solution is to give up being the selected Filing system when you are called upon to release the workspace. To do this you must change all the indirection vectors to point to a convenient RTS.

REASON CODE=&0B

Release NMI

This code indicates that the previous NMI claimant has released it and the original owner can have it back. Y contains the ID of the previous user and so should be compared against the ID of the ROM, if it is the same then A should be set to zero on return otherwise all

registers should be preserved. During this call filing system zero page should not be stamped on.

REASON CODE=&0C

Claim NMI.

This area is always reserved from BASIC if there are any sideways ROMs plugged in. To actually use it, OSBYTE should be called with A=&8F, X=&0C and Y=&FF to tell the previous user to relinquish it and stop causing NMIs. On return, Y will hold the previous user's Code ID, or &FF if it was not previously in use. When a piece of code has finished with NMI, OSBYTE should be called with A=&8F, X=&0B and Y=previous Code ID to allow the previous user to continue using it. On claiming NMI, the 8 bytes of NMI zero page become available. The contents of these bytes are lost when NMI is released, and so should be stored in a private allocation. Note: (i) It will be necessary to store the previous Code ID until NMIs are no longer required. (ii) There should be no need to check whether an NMI was caused by your hardware, as all other sources of NMI should have been turned off. However, it is probably better to check for and ignore spurious NMIs when speed is not critical, as this makes the system more robust. During this call filing system zero page should not be stamped on.

REASON CODE=&0F

Vectors claimed.

When a ROM claims the filing system indirections it should call OSBYTE with A=&8F, X=&0F; the reason for this is not entirely clear... see Paul for further details. During this call filing system zero page should not be stamped on.

REASON CODE=&12

Init filing system Y

This call enables a service to find out what filing system is active (with OSARGS A=0,Y=0) switch to something else and restart it by calling this. Therefore if Y equals your filing system number, init yourself and set A=0 to tell the world you've done it - simple isn't it! (n.b. As usual this is a facility that the SFS and CFS do not have and therefore they must be initialised by different means.)

4 Filing system Roms

In addition to the standard sideways ROM interface described above, a filing system has to make use of the filing system interface to obtain file related calls.

Initialisation

Three things can cause a filing system to become selected - a *command (eg. *DISC) detected by sideways call with A=&04, a sideways

call with A=&l2 and Y=<your filing system number>, or an Auto-boot at Reset time. Note that the relevant workspace must have been allocated at Reset-time (see sideways call with A=&01 & A=&02).

Auto-boot

On receipt of a sideways call with A=&03, the filing system should auto-boot if appropriate. The filing system should check at this point for things such as the presence of appropriate Hardware - there may be more than one FS in a standard ROM, and the user does not want the wrong one selected. (Actually, the test should have been performed at the workspace claiming stage, since the user of an Econet system does not want space reserved for disc file buffers if he has no disc but both FS's are in the same ROM). If Y=0 also, the FS should do something with a file called !BOOT, according to the possibilities of the FS in question (DFS & NFS offer the option of *RUN, *EXEC or *LOAD). Note that the Language has not yet woken up, so the response to any BRK will be silly unless the FS has temporarily indirected it, or deals with its errors in a different way (not difficult, since all errors usually pass through one routine which copies them out into RAM).

Action on initialisation

On initialisation, the filing system must claim the filing system indirections and the filing system workspace, if required (ie. usually).

To claim the filing system indirections, the previous owner must first be told to get out. This is achieved by a call to OSFSCM with A=&06. Since OSFSCM does not exist as a call in the OS, it is necessary to fabricate a JSR indirect through &021E (JSR to a JMP (&020E),RTS). Beware that zero page may disappear under your nose, so don't leave anything valuable in there. Next the indirections should be indirected to point to your code. This is a two stage process - first the main indirection must be set to point at location (&FF00+3*n) where the vector you are changing is at (&0200+2*n) - eg. the vector at &0212 would be set to &FF1B. Second, the three byte vectors whose address is found by a call to OSBYTE with A=&A8,X=&00,Y=&FF (the answer being in X and Y, X=lo byte) must be set to point to the actual routine. The three bytes go lo-byte,hi-byte,ROM id. The ROM id was in X on entry, but you have probably forgotten it, so it can be obtained from location &F4. Finally, OSBYTE should be called with A=&8F,X=&0F to indicate to any interested ROMs that you have taken over.

The OSFSCM Indirection

This is a vector through which the OS passes various filing system functions which it has decoded, giving a reason code in A.

Reason code &00

A *OPT command has been issued - the two parameters are in X and Y

Reason code &01

EOF check - the OS has received a call to OSBYTE with A=&7F to check for end of file conditions. Beware that the handle is in X rather than the usual Y. On return, X should be set to &FF if there is an end of

file on channel X, otherwise X should be set to &00.

Reason code &02

A */<filename> command has been received by the OS. This should usually be treated in the same way as *RUN, as this is a standard abbreviation.

Reason code &03

*command - this is the last chance : either the command should be recognised, or it should be treated as an unrecognised command. 'Fast' filing systems should attempt to *RUN the appropriate file, but slow systems should give a "Bad command" error, since the user does not want to wait for miles of tape to wind past before he realises that he has mis-spelt the *CAT command, for example. On entry, XY points to the command name. (X is 10 byte as usual)

Reason code &04

*RUN command. Load and execute the command pointed to by XY

Reason code &05

*CAT - print a catalogue. XY points to the rest of the command line in case you need parameters.

Reason code &06

Another filing system is about to take over the filing system vectors, so die gracefully - close the spool & exec files with OSBYTE call &77 and do anything else you think appropriate.

Reason code &07

Return the range of handles used by your filing system - X=<lowest value used>, Y=<highest value>

Reason code &08

This call occurs each time the OS is about to process a *command. This is used by the DFS to implement the *ENABLE mechanism, which is turned off by the next *command of whatever type.

Memory summary

Zero page:

&A0 to &A7 NMI area - may only be used after claiming NMI

&A8 to &AF

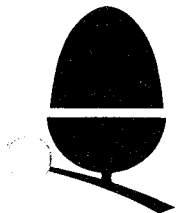
Utilities area - may be used by filing systems when processing *commands but at no other time.

&B0 to &BF

Filing system scratch space - use it, but don't expect it to remain the same between calls. Also, don't use it for IRQ routines.

&C0 to &CF

Filing system dedicated space - guaranteed to remain intact between



3.3 RS423 APPLICATION NOTE

It is often useful to be able to transmit and receive characters and data by means of the RS423 port, without affecting the use of the print stream to parallel (or otherwise connected) printers. This task is most easily accomplished from a BASIC program by making use of the OSBYTE calls available in the Series One MOS.

The following BASIC program makes use of these facilities to enable the BBC Micro to act as a 'Dumb' terminal.

NOTE THAT THIS PROGRAM REQUIRES MOS 1.0 OR GREATER.

```
10 REM DUMB TERMINAL
20 REM VERSION I
30 REM ACORN COMPUTERS
40 REM
50 REM ENABLE RS423
60 *FX 2,2
70 REM SET RECEIVE & TRANSMIT BAUD RATES
80 *FX 7,3
90 *FX 8,3
100 REM MAIN PROGRAM LOOP
110 REPEAT
120 A% = INKEY (0) [GET KEY FROM KEYBOARD]
130 IF A% > 0 : A% = FNTX (A%) [IF KEY PRESSED, SEND IT]
140 A% = FNRX [CHECK FOR RECEIVED CHARACTER]
150 IF A% > 0 : PRINT CHR$(A% AND & 7F) [IF VALID, PRINT IT]
160 UNTIL 0 [REPEAT INDEFINITELY]
170 REM
180 REM
190 REM FUNCTION TO RECEIVE CHARACTERS
200 DEF FNRX
210 A% = 145 : X% = 1 [CALL OSBYTE TO CHECK BUFFER]
220 R% = USR (&FFF4)
230 E% = R% AND & 10000000 [SET UP E% TO INDICATE IF CHARACTER RECEIVED]
240 Y% = (R% AND & FF0000) DIV & 10000 [MASK OUT CHARACTER]
250 IF E% : = -1 : ELSE = Y% [RETURN -1 OR CHARACTER]
260 REM
270 REM
```

```

280 REM FUNCTION TO TRANSMIT CHARACTER
290 DEF FNTX (Y%) [CALL OSBYTE TO TRANSMIT]
300 A% = 138 : X% = 2 [THE SUPPLIED CHARACTER]
310 = USR (&FFF4)

```

PROGRAM DESCRIPTION

The above program makes use of two vital operating system calls; the call with A% = 145 (line 210) checks to see if a character is present in the RS423 receive buffer and this call is documented in the User Guide on page 435. The other call with A% = 138 (line 300) puts a character into the RS423 transmit buffer and is described on page 433 of the User Guide. The *FX2,2 command on line 60 enables the RS423 receiver whilst allowing the keyboard to be used. This is described on page 421 of the User Guide. NOTE: There is an error in this section of the User Guide and *FX2,0 actually gets characters from the keyboard and DISABLES the RS423 receiver.

RS423 HARDWARE

The RS423 interface is upwards compatible with the RS232 standard, and whilst some electrical details differ, a number of important features are shared by both standards.

i) Electrical Characteristics

Both standards use negative voltages to represent logic One, and positive voltages to represent logic Zero. The RS423 interface uses -5V and +5V respectively.

The lines idle with continuous ones (i.e. -5V) when no data is being transmitted.

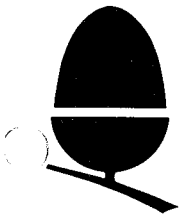
The RS423 standard specifies data transmission up to 4000 ft, but this length is variable subject to the data rate.

ii) Operating System Control

The CTS input to the computer must be logic One (i.e. -5V) for the computer to transmit data.

The RTS output from the computer indicates that the computer is ready to transmit data; this is acknowledged with CTS.

For operation with peripherals which do not support RTS/CTS handshaking, the two pins may be connected together, and a *FX2,2 command will enable operation.



3.4 CHANGING THE RS423 DATA FORMAT

The serial port on the BBC Micro by default transmits and receives data as 8 - bit bytes preceded by one start bit and followed by one stop bit. This format was chosen because of its generality, however, it is often necessary to alter this format in order to communicate with other devices.

The format can be altered to any of those shown below (fig. 1), by means of the FX/OSBYTE call with A = &9C (156) and X = appropriate value.

In order not to alter other parameters of the 6850 ACIA chip, a mask is supplied with the call specifying which bits are to be altered. This mask must be &E3 (227). The following data byte is then supplied to set the format.

<u>VALUE</u>	<u>FORMAT</u>
0	7 Bits + Even Parity + 2 Stop Bits
4	7 Bits + Odd Parity + 2 Stop Bits
8	7 Bits + Even Parity + 1 Stop Bit
12	7 Bits + Odd Parity + 1 Stop Bit
16	8 Bits + 2 Stop Bits
20	8 Bits + 1 Stop Bit
24	8 Bits + Even Parity + 1 Stop Bit
28	8 Bits + Odd Parity + 1 Stop Bit

Fig. 1

The call is made either by:-

*FX 156, VALUE (from above), 227

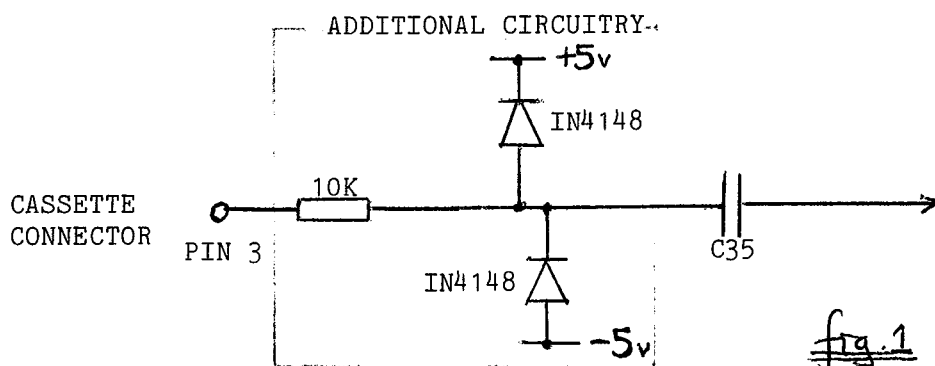
or by calling OSBYTE (JSR &FFF4)
with A = 156, X = VALUE (as above), Y = 227.

3.5 CASSETTE INTERFACE CIRCUITRY PROTECTION.

It has come to our notice that the cassette interface of the BBC Microcomputer can in some cases be damaged by certain tape recorders. The following additional circuitry can be added to any board in order to minimise this problem. (fig. 1)

COMPONENTS REQUIRED:

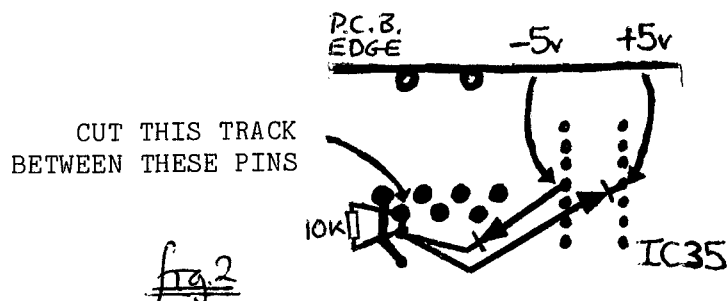
2 x 1N4148 Diode
1 x 10K $\frac{1}{4}$ Watt 10% Carbon Film Resistor



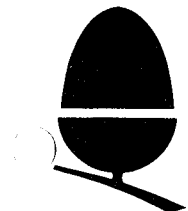
MODIFICATION:

The modification is performed as follows:

- i) Ensure the computer is disconnected from the mains
- ii) Disconnect the 7 power supply connectors from the main PCB, and disconnect or unsolder (as appropriate) the two connectors to the Video Out socket.
- iii) Unscrew the PCB and remove it from the case. Place it upside-down on a flat surface.



- iv) Identify the cassette socket and IC35 as shown in fig 2 above. Cut the track marked, and fit the 10K resistor and the two diodes as shown. Make sure that the leads from the diodes do not touch



any other of the pins of IC35, preferably by insulating them with a short length of heat-shrink sleeving or wire insulation.

- v) Re-install the main PCB by reversing (ii) and (i) above. This completes the modifacaiton.

3.6 *FX/OSBYTE features not documented in
the BBC MICROCOMPUTER USER GUIDES
FOR THE SERIES ONE M.O.S.

&0D (13)

Two undocumented parameters may be supplied in X to disable events:

- X = 7 disable RS423 receive error event
- X = 8 disable service/network error event

&0E (14)

As above, two undocumented parameters may be supplied in X to enable events:

- X = 7 enable RS423 receive error event
- X = 8 enable service/network error event

Events are explained on p 465 of the User Guide

&76 (117)

This call returns the VDU status byte (which contains various status flags) in the X register.

- BIT 0 - set if VDU2 sent, cleared by VDU3
- BIT 2 - set if PAGED MODE ON, cleared if PAGED MODE OFF
- BIT 3 - set if software scrolling, cleared if hardware scrolling

Software scrolling is used when text windows have been defined whereas hardware scrolls are used when the whole screen scrolls.

- BIT 5 - set when cursors joined by VDU 5
- BIT 7 - set if VDU disabled

&76 (118)

Returns with the carry bit set if the CTRL key is pressed, and with the Negative bit set if the SHIFT key is pressed. Machine code routines may branch on these conditions. This feature is invalid when called from a Second Processor.

&7B (123)

This call is used by the User Print Routine to indicate to the MOS that it has finished its task. (CF *FX 5.3 command). This feature should not normally be called from a Second Processor.

&8A (138)

This call has been expanded to allow a character to be inserted into any buffer.

X must contain the buffer number, and Y the character to be inserted. A list of buffer numbers appears with *FX 21 on p 428 of the User Guide.

&8D (141)

This command is exactly equivalent to the *ROM command.

&98 (152)

This call examines a buffer. The buffer number must be in X, and the call returns as follows:-

Carry bit set if buffer empty
Carry bit clear indicates character(s) present in buffer.
Note that no character has been removed from the buffer.

&99 (153)

The call inserts a character into an INPUT buffer handling the interrupt character, and generating an escape condition if necessary.

Valid only for X = 0 or 1
Y must contain character to be inserted

&9C (156)

Change 6850 control register.

The 6850 control register is altered to: (Old value AND Y) EOR X.

(See User Guide page 438)

Refer to the 6850 Data sheet for details of the 6850 control register.

&9E (158) /&9F (159)

These calls respectively read and write to the Speech Processor chip. Refer to the Speech System User Guide.

&E9 (233)

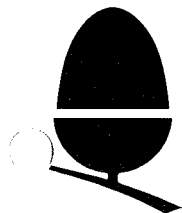
As for &E7 (see User Guide page 441) but affects the system 6522. The system 6522 is used extensively in the normal operation of the machine and consequently this call should be used with extreme care.

&EB (235)

Return presence of Speech Processor.

X = &FF if Speech Processor present
X = &00 if Speech Processor not present

&FI (241)



Read/Write *FX1 value

&F5 (245)

Read/Write *FX5 value

XF6 (246)

Read/Write *FX6 value

THESE THREE CALLS OPERATE AS DESCRIBED IN THE USER GUIDE ON PAGE 438.

&FC (252)

Reads I.D. of current language, a number from 0 to 15 which indicates which socket the presently selected language ROM is in. The sockets are numbered from right to left starting at 15. On board sockets are 15, 14, 13, 12; and the remainder can be installed offboard. This call may not be meaningful from a Second Processor, since there may not necessarily be a current language in this case.

&FD (253)

Returns a number indicating what sort of reset last occurred:

0 = Soft Break
1 = Power-On Break
2 = CTRL Break

&FE (254)

Read/Write available RAM in BBC Microcomputer (even when called from Second Processor)

128 = 32k
64 = 16k

&FF (255)

Read/Write start up option byte.

This allows the keyboard link value to be read: it may be written to, but the value will be reset to the actual wired value on any reset other than a soft-reset.

The links are configured as follows:

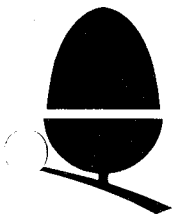
1 2 3 4 5 6 7 8
X X D₂ D₁ B M₃ M₂ M₁

D₂, D₁ : Disk configuration bits (see Disk Manual)

B : Auto-boot select (Auto-boot when fitted)

M₃, M₂, M₁ : Screen mode on hard reset (0 - 7)

X : Unused



3.7 PRODUCING COLOUR ON THE VIDEO OUT SOCKET

The BBC computer usually produces a black and white composite video signal through the Video Out Socket on the back panel, but it may be modified to produce a colour signal. This is achieved as follows:

On Issue 1, 2 and 3 PCB's, a 470 picoFarad capacitor should be fitted between the emitter of Q9 (identified by an "e" next to one leg) and the base of Q7 (the central leg).

On Issue 4 and later, the capacitor is on-board and can be connected simply by fitting link S39 which may be found next to the modulator in the far right corner of the PCB.

With the fitting of this capacitor, the colour burst signal is now fed to the video mixer and a colour monitor may be attached to the output socket. This allows the computer to be recorded on videotape etc.

The video output socket is specified for black and white in order to provide a stable high quality picture for word processing and other eighty character applications. It was decided that gating colour burst onto this output degraded the picture quality sufficiently to warrant the removal of this facility as standard.

3.8 BBC USER GUIDE ERRATA : UK VERSION

This is the current errata for the User Guide as supplied with all UK computers. (4/84)

- p13 The range of cassette leads shown have now been deleted.
- p23 The *FX command takes a second parameter which controls the interlace on Modes 0-6. If the second parameter is a 1 then interlace is turned on, if 0 then it is turned off. Note that the change in interlace operation only takes place after the next MODE command.
- p32 Insert a ':' after the ';' on line 115 of the example.
- p33 Insert a ':' after the ';' on line 160.
- p43 Add a '-' after '+/' on line 230.
- p53 (Second paragraph) Alter 'page 213' to 'page 211'.
- p61 Delete the space between 'RND' and '(4)' in line 100.

- p65 The arithmetic range extends from 170000 (1.7 * 10³⁸) to 0.000 (1.2 * 10⁻³⁹), not as shown.

- p67 In the second example program there should be a '\$' after each 'A' in line 40.

- p72 [BASIC II ONLY] At the top of the page, the maximum number of significant figures is 10, and the initial value of @% is &90A.

- p74 Add a ';' after "H" in line 40.
- p93 Alter line 100 of the example to read
FOR ROW = 1 TO 5.

- pl00 (3/4 down the page) All non-zero values are regarded as true EXCEPT non-integers from -1 to +1.

- pl43 (Top of page) Note that the "Auto-boot" mechanism does not work on the cassette filing system. (1/2 down the page) Change 'page 424' to 'page 422'.

- pl52 (3/4 down the page) The code for 'New Background' is 157 not 137 as shown.
- pl79 Line 10120 of the example should read MOVE X%,Y%.
- p204 (Last paragraph) 'page 428' should read 'page 426'.
- p288 Note that pressing <SHIFT> and <CTRL> together holds the listing until they are released, and that <ESCAPE> stops the listing.
- p327 Note that 'PRINT~' followed by a numeric argument prints that argument in hexadecimal.
- p328 (Paragraph concerning Integer Variables) Integers are sent MOST significant byte first, not least significant byte first as shown.
- p416 (First paragraph) The whole LINE after a '*' is passed to the Operating System, rather than just the rest of the statement.
- p421 Alter *FX2,0 to read '..and DISABLES the RS423 receiver.'
Alter *FX2,1 to read '..RS423 port, disables the keyboard.'

- p423 Add : *FX6,0 filters NO characters.
- p427 In paragraph six, 'After a *FX20,1 command...' the line should read 'After a *FX20,6 command...'
- p438 (Paragraph beginning 'If on entry,...') The net effect of X=&00 and Y=&FF is to read the value of V into X (not A as shown).
- p439 The second OSBYTE call shown is A=&E2(226) not &EA(228).
- p453 (Top paragraph) The channel number is returned in A not in Y as shown.
- p459 OSWORD A=0 : 'On exit....Y is set to the length of the line EXcluding the CR if C=0.' (Not INCLUDING as shown).
- p469- There should be '\' characters between the assembler
470 statements and the comments on EVERY line.
- p482 Add three error codes:
251 Bad Key
253 Bad String
254 Bad Command
- p488 The pattern for code 36 should be inverted (ie black:=white and white:=black).
- p489 The pattern for code 228 is upside-down.
- p490 The comments for codes 24 and 27 should be reversed (ie 27=Nothing).
- p497 The codes for the UP and DOWN cursor keys should be reversed.
- p499 The pin numbers on the disc, printer, user input/output, 1MHz bus and Tube have been reversed (e.g. on the Tube, the top right pin is pin1, the bottom left pin is pin34)
- p501 Delete the comment that &D00-&DFF is for user supplied routines. This area is RESERVED for the Operating system.

The remaining errata concern the index (p513++). Only the corrected line will be given.

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' apostrophe	324
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3.9 RANDOM KEYBOARD INTERRUPTS

Under certain circumstances, particularly when the user is utilising the various options available from the bank of links on the bottom right of the keyboard, the speed of operation of the BBC Microcomputer can be enhanced by the following modification designed to help reduce spikes on the output lines of the 74LS30 on the keyboard which generates machine interrupts.

This modification may be carried out on all BBC Microcomputers irrespective of the issue of the circuit board.

1. Disconnect the unit from the mains power supply, remove the four fixing screws and remove the lid.
2. Change resistors No. R4 to R11 to be 2K2 1/4W 5% these resistors are located at the bottom right of the main P.C.B. with the exception of R6 and R10 which are found on the centre of the right hand edge of the main P.C.B.
3. Alternatively fitting a 560pF capacitor across pins 7 and 8 of the keyboard 74LS30 will also cure the problem.
4. Reassemble and test the machine.

This completes the modification.

3.10 DIFFERENCES BETWEEN BASIC I AND BASIC II

During 1982, an enhanced version of BBC Basic was created by Acorn in response to requests from users for additional facilities. In particular it was felt that the 6502 Assembler, which is a component part of BBC Basic, could be improved by the addition of an ability to generate code for sideways ROM's and other memory areas not usually mapped to RAM. Some of the BASIC keywords have been extended so they are more powerful and some additional ones have been incorporated. Furthermore some of the arithmetic routines have been recoded for greater precision. In keeping with Acorn's policy of providing a series of enhancements to our software, the BASIC II ROM can be ordered from any Acorn dealer.

ISSUE II BASIC

The new version of BASIC's differences with the old version are as follows:-

- (1) ELSE no longer leaves a byte on the hardware stack in ON.. GOTO/GOSUB.
- (2) INSTR no longer leaves the shorter string of INSTR("AB","ABC") on the Software stack.
- (3) The lexical analyser is now called correctly from EVAL so that EVAL("TIME") works.
- (4) ABS can take the absolute value of integers without bit 31 set without returning a string (i.e. PRINT -ABS 1 works).
- (5) ASC":" can be used in the assembler without confusing it.
- (6) A new statement OSCLI has been introduced, shortest abbreviation OS., token value &FF. It takes a string expression and gives it to the operating system, e.g. OSCLI "KEY "+STR\$Z+". This is key "+STR\$Z. It has no unique errors of its own, just the normal "Type mismatch" error.
- (7) The value of the token for OPENIN has changed to &BE and now just opens files for input only using the &40 open. A new keyboard upenup (open for update) has been introduced with the old token value &AD which opens files for update using the &CO open. This results in old programs automatically changing to OPENUP when they are LOADED into the new interpreter.
- (8) The next bit in OPT (OPTs 4 to 7) controls whether code generated by the assembler will be put at the program counter P% or at the code original O%. If it is set code will be put at O% and both O% and P% incremented, if unset only P% will

be used. Current implementation results in all OPTs greater than 3 causing code to be put at 0%.

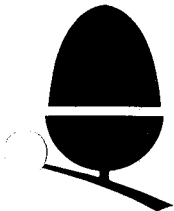
- (9) The LN and LOG functions are completely recoded to make them more accurate and to avoid the LN(2E-39) bug.
- (10) The fix routine avoids the INTLE38 bug.
- (11) The SIN/COS functions are completely recoded to make them more accurate.
- (12) The binary to decimal string conversion routines, used for PRINT and STR\$, have been changed to allow the use of 10 figures of precision on printing. The initial value of @% is now &0000090A to give the same results on startup. Note that @%=10 now gives the internal default of 10 figures. The changes allow the maximum positive integer 2147483647 to be printed out (and indeed get 2³² right). STR\$ when not controlled by @% uses the new 10 figure default which will result in it giving different answers to before e.g. 7.7 (a recurring binary fraction) will be converted to 7.699999999.
- (13) Four new operations are available in the assembler. These are EQUW, EQUW, EQUW, EQUW. They have no errors of their own apart from the Type mismatch error. They take a single argument and put its value into the assembly code. EQUW put all the characters of a string into the code WITHOUT a carriage return like \$P%; if you need a carriage return just add it to the string. EQUW may be used together with FN to implement macros as shown in this example:-

```

DEF FNOSBYTE (A,X,Y)
IF A>127 [OPT Z:LDY#Y:]
[OPT Z:LDX#X:LDA#A:JSR&FFF4:]
= ""

[OPT Z
EQUW FNOSBYTE(&99,33,44)
EQUW FNOSBYTE(2,1,0)
]
```

- (14) The startup REPORT is the way to tell the new version of BASIC from the old one, the new one has (c)1982.
- (15) The bug associated with ON ERROR GOTO 9999 has been removed.
- (16) A MODE change now resets COUNT
- (17) BASIC will now only execute if A contains 1 on entry at 8000. There is no entry at 8003 any more.
- (18) BASIC is of type 60; this means that it contains its own tube



relocation address after all the standard sideways ROM items. Of course, with the general release this will be 00008000 (the default for no relocation) but this gives more trouble free production of relocated versions to run at 0000B000.

- (19) The version number is 01.
 - (20) In INPUT ';' is introduced and functions as the ',' does.
 - (21) Fatal errors have been introduced. Errors whose ERR is zero cause an ON ERROR OFF effect while they are being processed.
 - (22) STOP has been redefined as a fatal error, this causes the STOP at line 0 message to be corrected to STOP.
 - (23) The "No room" error is a fatal error.
 - (24) The standard error handling procedures do not use stack any more. The situation of running out of all free space no longer causes error messages to be printed out following by a "No room" message.
 - (25) The allocation of space for strings has been made slightly more efficient, it can cope with REPEAT A\$=A\$+"*": UNTIL LEN A\$ = 255 and only allocate 255 bytes. It still has problems if B\$ is being done alternatively with A\$.
 - (26) A new error 45 "Missing #" arrives if PTR, EOF, BGET, BPUT, EXT have a missing #.
 - (27) DIM P% -2 gives Bad DIM
-

3.11 CASSETTE RECORDER USAGE WITH BBC AND ELECTRON COMPUTERS

Several cassette recorders have been checked for compatability with our computers by the Product Services group. Comments on these various devices appear below. The non-appearance of any recorder on this list does not imply any dissatisfaction - merely that it has not been checked.

BBC DATA RECORDER

Operation very good using DIN input.

BUSH 3150

Operation satisfactory using microphone input.

HITACHI TRQ-240R

Microphone input causes overloading. Use an attenuator or use the DIN input.

SANYO DR101

Best operation is obtained by using the unit in DATA mode, with REVERSE phase.

SANYO SLIM 3A

Operation is just about satisfactory using the microphone input, although performance can be improved by attenuating the input by about 25:1.

W.H.SMITH CCR800

Microphone input causes overloading. Use an attenuator or use the IN input. COMPUTE mode produces much better results than NORMAL mode.

W.H.SMITH CPD8300

SAVE input causes overload. AUX input produces good results in both SPECTRUM and OTHER modes. A meter reading of 2-4 is recommended for both recording and playback.

3.12 USE OF EPROMS IN SIDEWAYS ROM SOCKETS OF THE BBC MICROCOMPUTER

The following Ultra-Violet erasable EPROMs may be used in the sideways ROM sockets:

64K BIT PARTS

INTEL D2764 D2764-2
AMD AM2764DC AM2764-20DC
FUJITSU MBM2764-252

32K BIT PARTS

INTEL D2732, C2732 or B2732
HITACHI HN462732
NEC UPD2732
TEXAS 2532JL-45 or 2532JL-35
HITACHI HN462532G

mitsubishi M5L2764K parts are not recommended for use in the BBC Microcomputer.

3.13 BBC MICROCOMPUTER - PARALLEL PRINTER PORT

PRODUCTION MODIFICATION

The following changes must be made to the Issue 2 Board to conform with Issue 3.

CUTS

- 1 S1 centre pad. Side 1. Cut link to south pad.
- 2/3 S1 north pad. Side 1. Cut both tracks.
- 4 PL9 pin23. Side 1. Cut track.

LINKS

- 1 Join together 2 tracks previously connected to S1 north pin.
- 2 Join S1 north pin to IC27 pin 7.
- 3 Join IC27 pins 9 and 7 and leave S9 not linked.
- 4 Join IC87 pin 10 to north pin to R49.
- 5 Join track previously connected to PL9. pin 23 to PL9, pin 19 (Model B only).

COMPONENT CHANGE

- 1 S1 is replaced by a BC239 Transistor, pinned as follows:-
 - e - north pin
 - c - centre pin
 - b - south pin
- 2 R162 (4K7) should be inserted between existing holes 0.2" west of IC 70 pins 11 & 13.
- 3 Pin 26 of PL9 should be removed or cut too short to make contact.

This completes the modifications.

3.14 THE USER-PRINTER VECTOR

The BBC Microcomputer operating system (MOS) provides support for standard interfaces to serial (RS423) and parallel (Centronics) printers. However the facility also exists for a user to provide a printer driver for a non-standard printer interface, or to replace the standard MOS drivers with a customised handling of the interface.

The printer selection command *FX5 has an option (*FX5,3) to select the user supplied print routine which is called through the User Printer Vector (UPTV) at &222 (as shown at the top of page 512 in the user guide). This Vector should be modified to point to the user's print routine before the *F5,3 command is issued, so that the software will be called to initialise. The MOS communicates with the user print routine by 'reason codes' which are passed in the accumulator. These codes inform the user routine of events which may be of interest to it, and are as follows:

Reason code

- A=0 This call is a timer kick for polled printers. If a print routine is active then this call will be issued every centisecond to allow the routine to collect any characters which have arrived in the printer buffer. If the routine is dormant then this call will not be issued. This call is only available in MOS releases 1.1 and above. (For explanation of when a print routine is active and when it is dormant see reason code 1).
- A=1 This call 'wakes up' a previously dormant print routine to inform it that characters are present in the printer buffer. X contains the buffer number (which will be 3 in this case) and Y contains a number indicating which sort of printer is selected (From *FX5). The user printer is indicated by Y=3. The carry flag on exit from this call is significant: C=0 implies that the print routine remains active, C=1 informs the MOS that the routine is dormant and should be 'woken up' when more characters arrive in the printer buffer.
- A=2 This reason code indicates that a Control-B has been issued. This code is recognised as a command to start the print stream. No characters should be taken from the printer buffer until a Control-B is issued.
- A=3 A Control-C has been issued, which is a command to stop the printer stream.

For all of the above cases X holds the buffer identifier and Y holds the printer destination.

- A=5 A new printer destination has been selected by *FX 5,n. The

old selection is passed in the X register, the new selection is held in the location &F0 in zero page.

All registers should be preserved under all circumstances. All other reason codes are reserved by the MOS and must be ignored and flags should be preserved on unrecognized calls.

Characters should be taken from the printer buffer either by an interrupt driven task or by using the timer kick described above. These options may be implemented as follows:-

Interrupts

If the printer can use interrupts to indicate status, for example when it is ready to take another character, then the user routine may attach to the interrupt chain through the IRQ2 vector (&206). The interrupt service routine pointed to by IRQ2V should ensure that the interrupt was caused by the printer, and if it indicates that the printer is ready then the routine should attempt to take a character from the printer buffer and send it to the printer. If no character is available then the routine should disable the printer interrupt and inform the MOS that the routine is now DORMANT (by OSBYTE 123). A dormant printer task should also detach itself from the interrupt chain to avoid unnecessary overheads in interrupt processing. A printer routine which is dormant will be 'woken up' (by A=1) when more characters arrive in the printer buffer. A print routine which is not DORMANT is assumed to be taking characters from the printer buffer already, so is not called to 'wake up' when more characters arrive.

Timer kick

The timer driven routine should respond thus:

- 1 If the printer is busy then return
- 2 If the printer buffer was not empty then take characters and send them to the printer, then return.
- 3 If the printer buffer is empty then return DORMANT (by OSBYTE 123).

OSBYTE Calls

A=123 This call informs the MOS that the current printer task needs to be 'woken up' when more characters arrive in the printer buffer. That is, the printer task is now dormant.

A=145 This call removes characters from a buffer. The buffer number is specified in X. The printer buffer number is 3. if the carry is set then the buffer was empty, otherwise the Y register holds the character returned.

3.15 USE OF *FX3

Output characters destination

As a result of errors and omissions in the BBC User Guide, use of the *FX3 command is difficult, particularly when one destination, which is not the screen, is required.

The error in the User Guide is as follows:

Page 422: The chart of written character destinations shows four ticks in the Printer [Bit 2] column. There should not be ticks for FX 3,2 and 3,3.

There is an undocumented bit of this word (bit 3) which allows other bits to be overridden; this is summarised in the chart below:-

Value of n in decimal	Value of n binary				EFFECT			
	Bit 3	Bit 2	Bit 1	Bit 0	Printer	Screen	RS423	
0	0	0	0	0	√+	√	x	+ Printer controlled by VDU 1,2, 3 and *FX5 and *FX6
1	0	0	0	1	√+	√	√	
2	0	0	1	0	x	x	x	
3	0	0	1	1	x	x	√	
4	0	1	0	0	x	√	x	
5	0	1	0	1	x	√	√	
6	0	1	1	0	x	x	x	
7	0	1	1	1	x	x	√	
8	1	0	0	0	√*	√	x	* Printer controlled by *FX5 and *FX6 and automatically enabled
9	1	0	0	1	√*	√	√	
10	1	0	1	0	√*	x	x	
11	1	0	1	1	√*	x	√	
12	1	1	0	0	x	√	x	
13	1	1	0	1	x	√	√	
14	1	1	1	0	x	x	x	
15	1	1	1	1	x	x	√	

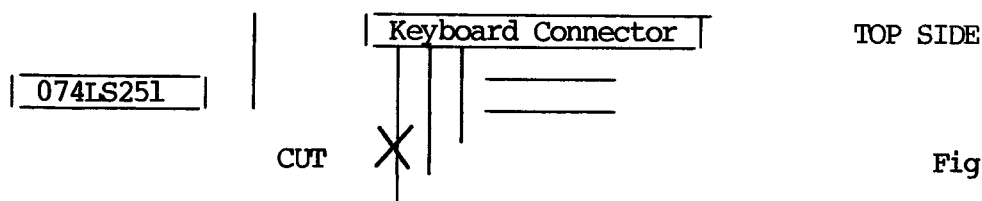
TABLE 1 - the effects of *FX3.n

Note that the appropriate printer must have been selected with *FX5, and that if a serial printer is selected with FX5 and RS423 is selected from the above chart (with FX3) then the output from the RS423 port is undefined.

3.16 CHANGING THE BREAK KEY

To disable the keyboard BREAK key:

The keyboard 'break' key may be disabled by cutting the wire link on the top side as shown in the diagram below.



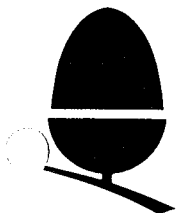
To fit a separate BREAK key to the rear of the machine:

A separate 'break' key may be fitted to the rear of the BBC Micro as follows:

Open the machine and locate the "reset" aperture on the back of the machine. Clear the hole by removing the perforated disc from the back fascia if necessary.

Fit a switch (Part No 531-25 by Britimpex) to the two empty holes adjacent to the aperture and solder.

Reassemble the case.



3.17 ROM FILING SYSTEMS

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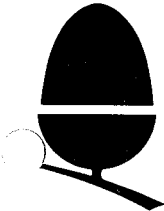
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PLEASE NOTE : throughout the listing of the "File Conversion Program" included in this document, all occurrences of the £ symbol should be changed to the # symbol.



*ROM Data Formatting Program

This utility program creates an EPROM image which when blown into a 4, 8 or 16 K byte device allows access to files via the *ROM filing system.

The program transfers data from files present on disc and reformats the data, outputting to an image file.

The *ROM Filing System

The *ROM filing system is selected by typing in *ROM. This filing system behaves in a similar manner to the Tape Filing System except that the source of the data is in ROM or EPROM. The data is formatted in blocks with CRC checking on both block headers and the blocks themselves.

The *ROM data format differs slightly from the *TAPE format in that only the block headers of the first and last blocks contain the full file information (name, load address, execution address etc); the intermediate block headers contain only a marker to indicate their status so that needless duplication of data is avoided thus minimising memory overheads.

Software Protection

The *ROM filing system offers a facility for software protection by allowing a file to be *RUN only. If the protection option is switched on for a *ROM file then that file will only be accessible by using the *RUN command. Attempts to LOAD, *LOAD or *EXEC the file will return the message: FILE LOCKED. Programs may thus be written so that once loaded and running they may not be recovered by the user for the purpose of copying.

Use of the Program

This program is largely self documenting as regards use and once this section has been read it is hoped that reference back to this document will not be necessary when running the program.

When creating a *ROM image access is required simultaneously from the files being transferred and to the file being created; it is envisaged that the image file will normally be formed on the disc containing the source files.

The program may be run by typing CHAIN "MAKEROM".

The first input required is the device memory size for which the *ROM data is intended. The program is set up to accept the numbers 4, 8 or 16 only.

A title for the *ROM image file is then required; only a valid file name will be accepted and a null file name will also be rejected.

*ROM Title

A *ROM title and number are prompted for so that a title may be placed at the head of the *ROM image. The title is a block of zero length incorporating the name and number of the *ROM. The actual title takes the form of the user supplied name followed by the number and preceded and followed by asterisks. The number must be in the range 0 to 15; in the title single digit numbers are padded with a zero.

The program then requires the user to enter a list of files which he wishes to incorporate into the *ROM image. The program tests each file as it is submitted testing for its presence on disc. Invalid filenames or files not present will be rejected and input may be resumed. Each input may consist of upto 4 items, the file name, a load address, an execution address and lock flag for switching in the software protect. The software protect flag is set by typing the letter L as the 4th item in the file input line. If the 4th item is not a letter L or there is no 4th item then the flag is not set.

During this input user specification of the load address, execution address and protect are optional and default values of zero and protect off will be used if only a file name is submitted. BASIC and text files do not require load or execution addresses and are unusable if protect is switched on. A null input (i.e. a carriage return only) terminates this input sequence. An input sequence may look like this:-

(Name) (Load address) (Execution address) (Protect)

The load address, execution address and protect are an optional parameter list. If any one parameter is to be defined all three parameters must be included.

e.g. ?MOIRE

?VERIFY 2800 2803

?FORM80 2800 2800 L

?KEYS

?

Where MOIRE is a BASIC program, VERIFY and FORM80 are machine code routines.

FORM80 has software protection set and so can only be used with the *RUN command. KEYS is a text file which may be used to set up some soft key definitions using the *EXEC command.

It is possible to send a line of input to the command line interpreter by entering a line preceded by an asterisk in response to the prompt. This allows the user to ascertain the file parameters from a disc file using the *INFO command. Should the user not know the execution address of a machine code program he wishes to include in the *ROM image he can ascertain this information without leaving the program.

The program prints each *ROM file block title, number and length as it is created, overwriting the previous block details until a new file is being output. When the program is finished the details of the last block of each file is present on the screen. The program finishes up by printing the amount of data contained in the image file.

If the amount of data output to the image file exceeds the length of the device size for which it is intended the program will terminate informing the user of this error condition and printing a '*** bad image' message. This message is incorporated into the error handling routine of the program and indicates that the *ROM image file is not in a legal *ROM data format or state. The '*** bad image' message should not be confused with error 215, 'Bad ROM' which the Operating System error message for a corrupt *ROM file (i.e. that message which would result from the attempt to blow and use a *ROM file which gave a '*** bad image' during its creation).

The Escape Key

Pressing the escape key will prematurely terminate the program at any time during a run sequence. In addition to the usual escape message the '*** bad image' message will be printed indicating that the partially formed image is not in a usable state.

Error states which are likely to be encountered

While it is hoped that this program protects the user from the consequences of most mistakes, he may still possibly provoke the BBC microcomputer into entering an error state which will halt the program. If an error condition is detected the message '*** bad image' will be printed followed by an operating system error message and a line number. The area in which the user is most likely to cause errors is the Disc filing system. If the user attempts to put files in a *ROM image which result in an image size greater than the device size for which the image is intended, the program will halt execution and print the messages 'Image length exceeds device size' and '*** bad image'. Errors encountered when the command line interpreter is used will be reported but the program will not be halted and the input sequence may be resumed.

Notes on file conversion

An important aspect of the use of *ROM files is that the *ROM file has a memory overhead associated with the division of the data into blocks. Thus it must be realised that a file which occupies 16 K bytes of disc file will not fit into a 16 K sideways ROM as a *ROM file. Each *ROM sideways ROM also has an area of data and code at its head which allows the Operating System to recognise it as a *ROM data ROM and which contains a copyright message. In practice the only sure way to test if a given combination of files will fit into a ROM image of a certain size is to try it out.

```

10REM FILE CONVERSION PROGRAM
20REM This program creates a ROM
30REM image in *ROM format from
40REM disc files. The ROM image
50REM is formed in a disc file.
60:
70II$=""
80ON ERROR GOTO1830
90CLOSE#0
100VDU15
110DIM FILES$(30),EXECS$(30),LADRS$(30),PROTS$(30),NU%
100 ,DISCNAME 20,MEM 18,CLI 20
120CCITTL%=&l0:CCITTH%=8:BLOCKSIZE%=256:DIM CRC% 4,CRC%
NT% 1,WORK% 4,Z% 50
130 DIM MM% 300,PB% 16,INDEX 1
140FORI=0TO2STEP2:PROCASSM(I):PROCASSM2(I):NEXT
150PROCINIT
160PROCtitle
170PRINT""Enter file details..."
180PRINT"File name followed by optional parameter list"
190PRINT"e.g."" TEMP 3000 3010 L"
200PRINT"<name> <load adr> <exec adr> <protect>"
210PRINT"a null entry terminates input"
220NFILES=0
230REPEAT:NFILES=NFILES+1:UNTIL FNaddfile
240NFILES=NFILES-1
250IF NFILES=0 GOTO230
260PRINT""Total length of files to be included is
&" ;~length%;" Bytes."
270IF length%>BB% PRINT"" Length of files to be includ
ed exceeds device size.""*** Bad ROM":CLOSE#0:END
280PRINT"in ";BLOX%;" blocks."
290FORQ%=1TONFILES:PROCWRITEFILE(FILES$(Q%),LADRS$(Q%),
EXECS$(Q%),PROTS$(Q%),Q%):PRINT:NEXTQ%
300PROCTERMINATE
310PRINT""ROM image occupies &" ;EXT#Y%;" Bytes."
320IF EXT#Y%>BB% PRINT""ROM image exceeds device size""
*** Bad ROM""
330CLOSE#0:REM CLOSE OUTPUT FILES ETC.
340 END :REM ** END OF MAIN PROG. **
350DEF FNaddfile
360INPUTII$
370Q1$="" :Q2%=0:Q3%=0:Q4%=0
380IFII$=""=:1
390IF LEFT$(II$,1)="*" $CLI=II$:X%=CLI MOD 256:Y%=CLI
DIV 256:CALL&FFF7:Y%=HANDLE%:GOTO360
400I=1
410Q1$=FNstn
420Q2%=EVAL("&0"+FNstn)
430Q3%=EVAL("&0"+FNstn)
440Q4%=ASC(FNstn)
450IF LENQ1$>7 PRINT"NAME TOO LONG : try again":GOTO360
460OO%=OPENUP(Q1$):IF OO%=0 PRINT"FILE NOT FOUND : try

```

```

again":GOTO360:ELSE length%=length%+EXT#00%: BLOX%=BLOX%+
(EXT#00 %+255)DIV 256:CLOSE#00%
470FILES$(NFILES)=Q1$:LADRS$(NFILES)=Q2%:EXECS$(NFILES)
=Q3 %:IF Q4%=ASC("L") PROTS$(NFILES)=1
480=0
490DEF FNstn
500AA$=""
510REPEAT
520TT$=MID$(II$,I,1)
530I=I+1
540AA$=AA$+TT$
550UNTIL I>LENII$ OR MID$(II$,I,1)=" "
560REPEAT
570I=I+1
580UNTIL I>=LENII$ OR MID$(II$,I,1)<>" "
590=AA$
600DEFPROCWRITEFILE(FILE$,LADDR%,EXEC%,F%,C%)
610REM FIRST FILE IS TITLE, LENGTH ZERO
620IF C%>0 THEN SRCHAND%=OPENUP FILE$:LEFT%=EXT#SRCHAND
% ELSE LEFT%=0
630BLOCKNO%=0
640REM SET POINTER TO NEXT FILE IN SIRROM
650BLKPOINT%=offset%+EXT#HANDLE%+FNfilelength(LEFT%,FIL
E$)
660REPEAT
670THISBLOCK%=LEFT%-BLOCKSIZE%
680IF THISBLOCK%>0 THEN PROCBLOCK(BLOCKSIZE%, BLOCKNO%,
F%,BLKPOINT%)ELSE PROCBLOCK(LEFT%,BLOCKNO%,F% OR &80,BLKP
OINT%)
690LEFT%=LEFT%-BLOCKSIZE%:BLOCKNO%=BLOCKNO%+1
700UNTILTHISBLOCK%<=0
710IF C%>1 THEN CLOSE#SRCHAND%
720ENDPROC
730DEFPROCBLOCK(BKLEN%,NUMBER%,FLAG%,NXTPTR%)
740REM
750REM PUTS OUT BLOCK OF LENGTH%
760REM
770PRINTFILE$,NUMBER%,BKLEN%,CHR$11
780IF BLOCKNO%=0 OR (FLAG%AND&80)>0 THEN PROCBYTEOUT(AS
C("***"))ELSE PROCBYTEOUT(ASC("#")):GOTO 830
790REM Note middle blocks are marked with a # char.
only and
800REM have no other header
810REM
820PROCHEADER:REM OUTPUT HEADER
830!CRC%=0
840IF EXT#HANDLE%+BKLEN%>=BB% PRINT'"ROM image exceeds
device size"' *** Bad ROM":CLOSE#0:END
850IF BKLEN%=0 THEN ENDPROC
860FORI%=1TOBKLEN%:A%=BGET#SRCHAND%:CALLsend:CALL
ADDCRC:N EXT
870RAMPTR%=RAMPTR%+BKLEN%
880A%=CRC%?1:CALL send

```

```

890A%=?CRC%:CALL send
900ENDPROC
910DEFPROCHEADER
920REM
930REM PUTS OUT HEADER
940REM
950!CRC%=0
960FORI%=1TOLEN(FILE$)
970PROCCRCBYTES(ASC(MID$(FILE$,I%,1)),1)
980NEXT
990PROCCRCBYTES(0,1):REM ZERO TERMIN.
1000PROCCRCBYTES(LADDR%,4)
1010PROCCRCBYTES(EXEC%,4)
1020PROCCRCBYTES(NUMBER%,2)
1030PROCCRCBYTES(BKLEN%,2)
1040PROCCRCBYTES(FLAG%,1)
1050PROCCRCBYTES(NXTPTR%,4)
1060A%=CRC%?1:CALLsend
1070A%=?CRC%:CALLsend
1080ENDPROC
1090DEFPROCRCBYTES(T%,N%)
1100LOCALI%
1110!WORK%=T%
1120FORI%=0TON%-1
1130A%=WORK%?I%:CALL send:CALL ADDCRC
1140NEXT
1150ENDPROC
1160DEFPROCBYTEOUT(A%)
1170CALLsend
1180ENDPROC
1190DEFPROCASSM(O%)
1200P%=Z%
1210[ OPTO%
1220.ADDCRC SEC:ROR CRCCNT%:EOR CRC%+1
1230STA CRC%+1
1240.CRCLP1 LDA CRC%+1:ROLA:BCC CRCLB1
1250RORA:EOR#CCITTH%:STACRC%+1
1260LDACRC%:EOR#CCITTL%:STACRC%:SEC
1270.CRCLB1 ROLCRC%:ROLCRC%+1:LSR CRCCNT%:BNE CRCLP1
1280RTS
1290]
1300ENDPROC
1310DEFPROCINIT
1320LOCAL T$
1330VDU12:PRINT""
1340REPEATINPUT"EPROM size in Kbytes : (16,8 or 4) ? "
BB%:UNTILBB%=4 OR BB%=8 OR BB%=16
1350INPUT "New ROM image filename ? "$DISCNAME :IF LEN
$DIS CNAME >7 PRINT"NAME TO LONG : try again":GOTO1350
1360IF $DISCNAME="" GOTO1350
1370BB%=BB%*400
1380?MEM=DISCNAME MOD256:MEM?1=DISCNAME DIV256:MEM!2=0:
ME M!6=0

```

```

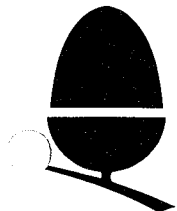
1390MEM!10=0:MEM!14=BB%+128:X%=MEM MOD 256:Y%=MEM DIV
256
1400A%=0:CALL&FFDD
1410Y%=OPENOUT $DISCNAME:HANDLE%=Y%
1420PTR#HANDLE%=EXT#HANDLE%:REM ADD TIMEO END OF FILE
1430PROCstartswrom
1440ENDPROC
1450DEFPROCTERMINATE
1460PROCBYTEOUT(ASC("+")):REM ROM TERMINATOR
1470ENDPROC
1480REM
1490REM
1500DEFFNfilelength(L%,FILENM$)
1510LOCAL bkohead%,R%,nbks%,smallohead%
1520REM
1530REM Calculate length in bytes of a cassette
1540REM format file.
1550REM
1560bkohead%=LENFILENM$+22+1:REM block overhead for
normal block
1570smallohead%=1+2:REM for short block=header char. +
data
CRC
1580IF L%=0 THEN R%=bkohead%-2:GOTO 1630:REM zero length
file
1590nbks%=(L% DIV BLOCKSIZE%)+SGN (L% MOD BLOCKSIZE%)
1600IF nbks%<=2 GOTO 1620 :REM no small blocks
1610REPEAT:R%=R%+smallohead%:nbks%=nbks%-1:UNTILnbks%<=2
1620REPEAT:R%=R%+bkohead%:nbks%=nbks%-1:UNTILnbks%=0
1630=R%+L%
1640DEFPROCstartswrom
1650REM
1660REM reads in preamble for paged rom from data
statements.
1670REM Also sets ?&80 to zero so
1680REM bytes are not reversed.
1690REM Also sets offset% to &8000 since this is start
of S W rom
1700REM
1710offset%=&8000
1720?&80=0:REM Don't reverse data bytes
1730FORI%=1TO &82:READ,Q%:BPUT#HANDLE%,Q%:NEXT
1740ENDPROC
1750DEF PROCASM2(O%)
1760P%=NU%
1770[OPTO%
1780 .send STA &70
1790.EXIT JSR &FFD4
1800RTS
1810]
1820ENDPROC
1830IF LEFT$(II$,1)="*" AND ERR<>17:REPORT:NFILES=NFILES
-1: PRINT:Y%=HANDLE%:GOTO230

```

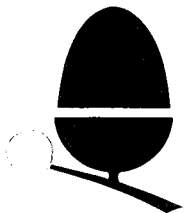
```

1840PRINT''' *** Bad ROM":REPORT:PRINT" at line ";ERL'
1850CLOSE#0
1860END
1870DEF PROCtitle
1880PRINT
1890INPUT"ROM Title ?"ROMTITLE$
1900REPEATINPUT"ROM Number ?"ROMNO%:UNTILROMNO%>=1 AND
ROMNO%<16
1910IF ROMNO%<10 THEN T$="0"+STR$ROMNO% ELSE T$=STR$ROMNO%
1920ROMTITLE$="*"+ROMTITLE$+T$+"*"
1930PROCWRITEFILE(ROMTITLE$,0,0,1,0)
1940ENDPROC
1950DATA 0
1960DATA 0
1970DATA 0
1980DATA 76
1990DATA 46
2000DATA 128
2010DATA 130
2020DATA 21
2030DATA 0
2040DATA 83
2050DATA 101
2060DATA 114
2070DATA 105
2080DATA 97
2090DATA 108
2100DATA 32
2110DATA 82
2120DATA 111
2130DATA 109
2140DATA 0
2150DATA 48
2160DATA 0
2170DATA 40
2180DATA 67
2190DATA 41
2200DATA 32
2210DATA 49
2220DATA 57
2230DATA 56
2240DATA 50
2250DATA 32
2260DATA 65
2270DATA 99
2280DATA 111
2290DATA 114
2300DATA 110
2310DATA 32
2320DATA 67
2330DATA 111
2340DATA 109
2350DATA 112

```



2360DATA 117
2370DATA 116
2380DATA 101
2390DATA 114
2400DATA 0
2410DATA 201
2420DATA 13
2430DATA 240
2440DATA 5
2450DATA 201
2460DATA 14
2470DATA 240
2480DATA 30
2490DATA 96
2500DATA 72
2510DATA 32
2520DATA 123
2530DATA 128
2540DATA 197
2550DATA 244
2560DATA 144
2570DATA 19
2580DATA 169
2590DATA 130
2600DATA 133
2610DATA 246
2620DATA 169
2630DATA 128
2640DATA 133
2650DATA 247
2660DATA 165
2670DATA 244
2680DATA 32
2690DATA 125
2700DATA 128
2710DATA 133
2720DATA 245
2730DATA 104
2740DATA 169
2750DATA 0
2760DATA 96
2770DATA 104
2780DATA 96
2790DATA 72
2800DATA 152
2810DATA 48
2820DATA 21
2830DATA 32
2840DATA 123
2850DATA 128
2860DATA 197
2870DATA 244
2880DATA 208



2890DATA 243
2900DATA 160
2910DATA 0
2920DATA 177
2930DATA 246
2940DATA 168
2950DATA 230
2960DATA 246
2970DATA 208
2980DATA 230
2990DATA 230
3000DATA 247
3010DATA 76
3020DATA 78
3030DATA 128
3040DATA 165
3050DATA 245
3060DATA 73
3070DATA 255
3080DATA 41
3090DATA 15
3100DATA 168
3110DATA 32
3120DATA 185
3130DATA 255
3140DATA 168
3150DATA 76
3160DATA 100
3170DATA 128
3180DATA 165
3190DATA 245
3200DATA 73
3210DATA 255
3220DATA 41
3230DATA 15
3240DATA 96

3.18 THE BUFFER INDIRECTIONS

All buffer handling on the BBC Machine is handled by 3 routines, each of which is indirected. The indirections are:-

- 1 &22A Insert into buffer
- 2 &22C Remove from buffer or examine buffer
- 3 &22E Count characters in input buffer, free slots in output buffer or purge buffer.

The interfaces are as follows:-

1 Insert

ENTRY:- A = character
 X = buffer number
 Y,P irrelevant

 EXIT:- X preserved
 A,Y corrupt
 C = 1 <=> buffer was full

2 Remove/Examine

ENTRY:- X = buffer number
 A,Y irrelevant
 V = 1 <=> examine option required

 EXIT:- X preserved
 Y = character if found
 C = 1 <=> buffer was empty
 A corrupt

3 Count/Purge

ENTRY:- X = buffer number
 A,Y irrelevant
 V - 1 <=> purge

EXIT:- for purge X preserved

A,Y,P corrupt

for count YX = count (Y high X low)

A,P corrupt

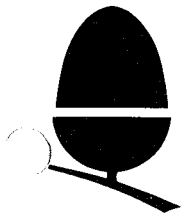
3.19 FITTING A V.T.I. VIDEO PROCESSOR TO THE BBC MICROCOMPUTER:

A small modification is required when the first iteration V.T.I. video processor is fitted to the BBC Micro. This iteration can be identified by the numbers VC2023 and 201647 printed on the top.

The second iteration of this chip does not require this modification and can be identified by the numbers VC2069 printed on the top of the chip. The V.T.I. processor is a semi-custom I.C. rather than an uncommitted logic array of the kind used in the past, and one of its features is that the video invert pin needs to be gated by a signal indicating use of Teletext mode to provide a correct picture. All P.C.B.'s using the original U.L.A. chip need the following modification to facilitate this:

- 1) Unscrew the four fixing screws which retain the top of the case and identify the existing Video Processor (IC 6). Remove IC6 and replace it with the V.T.I. chip.
- 2) Remove the Molex jumper from S26 and connect a short length of insulated wire between the central pin of S26 and Pin 1 of IC10.
- 3) Reassemble the case and tighten the fixing screws.

This completes the modification.



3.20 TELETEXT MODE DETERIORATION

Under certain circumstances the Mode 7 screen display of the BBC Microcomputer becomes unstable and breaks up. This is due to "signal race" caused by "fast" TTL to pins 19 and 20 of the SAA5050. This can be distinguished from other display deterioration problems caused by the Video Processor because it will affect only Mode 7 leaving a normal display in Modes 0 - 6. This can be corrected with the simple modification that follows:

1. Disconnect the unit from the mains power supply, remove the four fixing screws and remove the lid.
2. Locate C48 which you will find between IC's 37 and 38 directly to the right of the Video Processor. Change the value of this capacitor from 270pF to 220pF.
3. Replace the lid, secure the four fixing screws and test the machine

This completes the modification.

<u>EQUIPMENT</u> BBC MICROCOMPUTER MODEL A TO B UPGRADE KIT		<u>HEIGHT (mm)</u> N/A	<u>WIDTH (mm)</u> N/A	<u>FROM:</u> <i>Geoffrey Vincent</i> PROJECT LEADER
<u>ORDER CODE</u> ANA 11	<u>PART NUMBER</u> 003,970	<u>DEPTH (mm)</u> N/A	<u>MATERIAL</u> N/A	<u>TO:</u> CUSTOMER SERVICES SALES ACCOUNTS R & D MANAGER CHIEF ENGINEER PRODUCT SERVICES GROUP LEADER
<u>FUNCTION</u> Allows Model A or Model A + E computer to be upgraded to Model B or B + E respectively		<u>COLOUR</u> N/A	<u>CONSTRUCTION</u> N/A	
<u>OPERATES WITH (Peripherals)</u> Model B provides circuitry and connectors for RGB video output, RS423, parallel printer (centronics), 1 MHz bus, Tube, User IO port and disc (connector only)		<u>CONTROLS</u> (Switches, pots., keyboards) None		
<u>SIMILAR EQUIPMENT</u> Model B (ANB 01) Model B + E (ANB 02)		<u>INDICATORS</u> (Meters, lamps, readouts, audible) None		
<u>MAJOR COMPONENTS</u> 16k of RAM A/D Converter and Connector RS423 Interface ICs and Connector 1MHz Bus Buffers and Connector "Tube" Connector Printer and User Port ICs and Connectors Disc Drive Connector RGB Socket		<u>SIGNAL CONNECTIONS</u> (V,A,Z, Baudrates, frequencies, connector type) A/D: 15-way PCB Mounting "D" Type: Max. 5 volts RS423: 5-way Domino "DIN" PCB Mounting: Max. 5 volts: Max. 19200 Baud 1MHz: 34-way 90° IDC Header with LE Ears: Standard TTL at 1MHz Tube: 40-way 90° IDC Header with LE Ears: Standard TTL at 2MHz Printer: 26-way 90° IDC Header with LE Ears: Standard Centronics Interface User: 20-way 90° IDC Header with LE Ears: Standard 6522 Interface Disc: 34-way 90° IDC Header with LE Ears: Remainder N/A Without Disc Interface Fitted <u>POWER IN</u> (V,A,V,HZ,Connector type) None <u>POWER OUT</u> (V,A,W,HZ, Connector Type) None		
<u>DESCRIPTION OF OPERATION</u> Full specification upgrade from Model A to B or Model A + E to B + E		<u>APPROVALS</u> (BS,FCC,CSA, UL,VDE,IEAB) None <u>GUARANTEE</u> 6 months <u>WEIGHT (KG) UNIT ONLY</u> 0.2 <u>WEIGHT (KG) INC. PACKAGING & ACCESSORIES</u> 0.25 <u>ACCESSORIES INCLUDED</u> None		
<u>CAPACITY</u> Increases memory size of computer to 32k (from 16k)	<u>FORMAT</u> N/A	<u>PACKAGING</u> Polystyrene and shrinkwrap Jiffy Bag		
<u>SPEED</u> (operating frequency) 2 MHz CPU Clock	<u>INSTALLATION</u> Dealer	<u>APPENDICES</u> None <u>DRAWING NUMBER</u> 003,970/E <u>ISSUE</u> 1 <u>DATE</u> 4.83 <u>APPROVED FOR PRE-PRODUCTION RELEASE</u> <i>Ch. Eng.</i> CH. ENG. COPYRIGHT 1983 ACORN COMPUTERS LTD.		

<u>EQUIPMENT</u> SPEECH UPGRADE KIT (BBC COMPUTER)		<u>HEIGHT</u> (mm) N/A	<u>WIDTH</u> (mm) N/A	<u>FROM:</u> <i>Geoffrey Vint</i> PROJECT LEADER
<u>ORDER CODE</u> TBA	<u>PART NUMBER</u> 003,950	<u>DEPTH</u> (mm) N/A	<u>MATERIAL</u> N/A	<u>TO:</u> CUSTOMER SERVICES SALES ACCOUNTS R & D MANAGER CHIEF ENGINEER PRODUCT SERVICES GROUP LEADER MANUFACTURING
<u>FUNCTION</u> To provide the user with the voice synthesis facility on the BBC machine, plus keyboard slots for additional ROM cartridges.		<u>COLOUR</u> N/A	<u>CONSTRUCTION</u> N/A	
<u>OPERATES WITH</u> (Peripherals) Any BBC Microcomputer		<u>CONTROLS</u> (Switches, pots., keyboards) NONE		
<u>SIMILAR EQUIPMENT</u> None		<u>INDICATORS</u> (Meters, lamps, readouts, audible) None		
<u>MAJOR COMPONENTS</u> Voice Synthesis I.C. (VSP) Phrase ROM "A" (VSM) Keyboard Interconnector Two Edge Card Connectors		<u>SIGNAL CONNECTIONS</u> (V,A,Z, Baudrates, frequencies, connector type) 7 Data Lines. Direct interconnection within computer. 2 x 15 way Edgecard connectors on keyboard for ROM Cartridges. Protected by slot cover until required.		
<u>DESCRIPTION OF OPERATION</u> Speech data (compressed using pitch-excited LPC) is supplied to the VSP by direct serial access of the VSM. The VSP decodes the data to construct a time-varying digital filter model of the vocal tract. This model is excited with a digital representation of either glottal air impulses or the rush of air. The output of this model is passed through an 8-bit D to A converter to produce a synthetic speech wave form.		<u>POWER IN</u> (V,A,W,HZ,Connector type) All power available from BBC Microcomputer internal PSU		<u>POWER OUT</u> (V,A,W,HZ, Connector Type) None
		<u>APPROVALS</u> (BS,FCC,CSA, UL,VDE,BEAB) None		<u>GUARANTEE</u> 6 months
		<u>OPERATING TEMPERATURE</u> (°C) 0 - 35°C		<u>WEIGHT</u> (KG) UNIT ONLY 0.2 <u>WEIGHT</u> (KG) INC. PACKAGING & ACCESSORIES 0.3
<u>CAPACITY</u> 128k bit ROM		<u>PACKAGING</u> Polystyrene, shrink wrap and jiffy bag		<u>ACCESSORIES INCLUDED</u> BBC Speech System User Guide
<u>SPEED</u> (operating frequency) 40 Hz frame rate	<u>INSTALLATION</u> Dealer	<u>APPENDICES</u> None		<u>DRAWING NUMBER</u> 003,950 / E <u>ISSUE</u> 1 <u>DATE</u> 2-83
		<u>APPROVED FOR PRE-PRODUCTION RELEASE</u> <i>Ch. Eng.</i>		<u>CH. ENG.</u> COPYRIGHT 1983 ACORN COMPUTERS LTD.

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4.3 TO ADD A 5 1/4" DISC UPGRADE TO A MODEL 'B' BBC MICROCOMPUTER:

1 Following parts are required:-

1 off I.C.	8271	IC78
2 off I.C.	7438	IC's 79,80
1 off I.C.	74LS10	IC82
2 off I.C.	74LS393	IC's 81,86
2 off I.C.	CD4013B	IC's 83,84
1 off I.C.	CD4020B	IC85
1 off I.C.	74LS123	IC87
1 off I.C.	2764-Eprom D.F.S	IC52
1 off I.C.	OS 1.2 ROM	IC51

2 Insert the IC's listed above into the sockets provided on the main board.

3 On issue 1 and 2 boards, connect the two pads of S8 with an insulated wire link.

4 If an OS 0.1 ROM is fitted in position IC51 then it must be removed. Insert an OS 1.2 ROM in its place.

5 If the existing power supply unit does not have an Auxiliary Power outlet it must be exchanged for one that does (e.g. Astec).

6 On issue 1,2 or 3 boards ONLY, cut the track connected to IC27 Pin 9 on the component side of the PCB between IC27 and IC89. Cut IC27 Pin 9 close to the PCB and bend the remaining part of the leg horizontal; then reconnect the IC leg to the East pad of S9 with a short length of insulated wire.

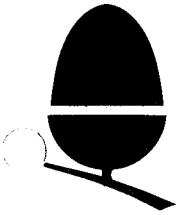
7 Ensure the links listed below are set as shown:

- S9 - Open
- S18 - North
- S19 - East
- S20 - North
- S21 - Both links facing East/West
- S22 - North
- S32 - West
- S33 - West

8 Ensure that S2 is Closed unless an Econet interface is fitted, in which case it MUST be Open.

9 Test the machine using a FIT test station. The Disc Test Kit may be used to test just the interface.

The upgrade is now completed.



4.4 SPEECH SYSTEM USER GUIDE ERRATA:

The following errata had been detected in the Speech System User Guide at 30/4/84:

p3 Parts 9 and 10 should be 47nF in both cases.

p23[Paragraph numbered (1)]

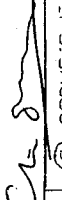
The bytes &4C and &43 have had their hexadecimal representation reversed. Further down the paragraph, the binary pattern &6BBC3 has its last two nibbles (nibble=4 bits) similarly reversed.

p31 Word number 138 in the list should show the word '-Z'.
Words 170,172,173,174 are missing a leading '1' in the Absolute Address (hex) column.

ACORN COMPUTERS LTD. ENGINEERING INFORMATION SHEET

<u>EQUIPMENT</u> LEVEL 1 FILE SERVER DISC - 40 TRACK		<u>HEIGHT (mm)</u> N/A	<u>WIDTH (mm)</u> N/A	<u>FROM:</u>  PROJECT LEADER
<u>ORDER CODE</u> AES 20	<u>PART NUMBER</u> 012,011	<u>DEPTH (mm)</u> N/A	<u>MATERIAL</u> N/A	<u>TO:</u> CUSTOMER SERVICES SALES ACCOUNTS R & D MANAGER CHIEF ENGINEER PRODUCT SERVICES GROUP LEADER
<u>FUNCTION</u> Econet system users share a simple multi-user filing system based on the BBC DFS		<u>COLOUR</u> N/A	<u>CONSTRUCTION</u> N/A	
<u>OPERATES WITH (Peripherals)</u> BBC Microcomputer system model B + D + E and 40T disc drive		<u>CONTROLS (Switches, pots., keyboards)</u> None		
<u>SIMILAR EQUIPMENT</u> Level 1 File Server (80 Track) (AES 23)		<u>INDICATORS (Meters, lamps, readouts, audible)</u> None		
<u>MAJOR COMPONENTS</u> A serialised 40 track DFS disc containing the following as:- \$.FS \$.VERIFY L.VIEW L.DS \$.FSUTIL \$.FORMAT L.REMOTE L.FS \$.NETMON L.NOTIFY		<u>SIGNAL CONNECTIONS (V,A,Z, Baudrates, frequencies, connector type)</u> None		
<u>DESCRIPTION OF OPERATION</u> Provides a limited number of files per user, identified by DFS directory. One directory is designated "public" and is read-only to all users. A subset of the DFS commands are supported.		<u>POWER IN (V,A,W,HZ, Connector type)</u> None		<u>POWER OUT (V,A,W,HZ, Connector Type)</u> None
		<u>APPROVALS (BS,FCC,CSA, UL,VDE,BEAB)</u> None		<u>GUARANTEE</u> 6 months
		<u>OPERATING TEMPERATURE (°C)</u> 0 - 35°C		<u>WEIGHT (KG) UNIT ONLY</u> 0.1 <u>WEIGHT (KG) INC. PACKAGING & ACCESSORIES</u> 0.15
		<u>PACKAGING</u> Six pack-wrap to cardboard stiffener, pack into jiffy bag		<u>ACCESSORIES INCLUDED</u> Introduction Sheet Operators Manual (A5) Station User Leaflet (6 copies)
<u>CAPACITY</u> 100k	<u>FORMAT</u> BBC DFS	<u>APPENDICES</u> None		
<u>SPEED (operating frequency)</u> N/A	<u>INSTALLATION</u> User	<u>DRAWING NUMBER</u> 012,011/E		<u>APPROVED FOR PRE-PRODUCTION RELEASE</u> 
		<u>ISSUE</u> 1	<u>DATE</u> 4.83	© COPYRIGHT 1983 ACORN COMPUTERS LTD.

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<u>EQUIPMENT</u> LEVEL 1 FILE SERVER DISC - 80 TRACK		<u>HEIGHT (mm)</u> N/A	<u>WIDTH (mm)</u> N/A	<u>FROM:</u>  PROJECT LEADER
<u>ORDER CODE</u> AES 23	<u>PART NUMBER</u> 012,012	<u>DEPTH (mm)</u> N/A	<u>MATERIAL</u> N/A	<u>TO:</u> CUSTOMER SERVICES SALES ACCOUNTS R & D MANAGER CHIEF ENGINEER PRODUCT SERVICES GROUP LEADER
<u>FUNCTION</u> Econet system users share a simple multi-user filing system based on the BBC DFS		<u>COLOUR</u> N/A	<u>CONSTRUCTION</u> N/A	
<u>OPERATES WITH (Peripherals)</u> BBC Microcomputer system model B + D + E and 80 track disc drive		<u>CONTROLS (Switches, pots., keyboards)</u> None		
<u>SIMILAR EQUIPMENT</u> Level 1 File Server (40 Track) (AES 20)		<u>INDICATORS (Meters, lamps, readouts, audible)</u> None		
<u>MAJOR COMPONENTS</u> A serialised 80 track DFS disc containing the following files:- \$.FS \$.VERIFY L.VIEW L.DS \$.FSUTIL \$.FORMAT L.REMOTE L.FS \$.NETMON L.NOTIFY		<u>SIGNAL CONNECTIONS (V,A,Z, Baudrates, frequencies, connector type)</u> None		
<u>DESCRIPTION OF OPERATION</u> Provides a limited number of files per user, identified by DFS directory. One directory is designated "public" and is read-only to all users. A subset of the DFS commands are supported.		<u>POWER IN (V,A,W,HZ, Connector type)</u> None		<u>POWER OUT (V,A,W,HZ, Connector Type)</u> None
<u>CAPACITY</u> 800k		<u>APPROVALS (BS,FCC,CSA, UL,VDE,BSAB)</u> None		<u>GUARANTEE</u> 6 months
		<u>OPERATING TEMPERATURE (°C)</u> 0 - 35°C		<u>WEIGHT (KG) UNIT ONLY</u> 0.1 <u>WEIGHT (KG) INC. PACKAGING & ACCESSORIES</u> 0.15
		<u>ACCESSORIES INCLUDED</u> Introduction Sheet Operators Manual (A5) Station User Leaflet (6 copies)		
<u>INSTALLATION</u> User		<u>APPENDICES</u> None		<u>DRAWING NUMBER</u> 012,012/1
<u>SPEED (operating frequency)</u> N/A		<u>ISSUE</u> 1 <u>DATE</u> 4.8.83		<u>APPROVED FOR PRE-PRODUCTION RELEASE</u>  FNL.

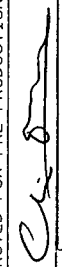
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<u>EQUIPMENT</u> ECONET CLOCK BOX		<u>HEIGHT (mm)</u> Clock 40 PSU 60	<u>WIDTH (mm)</u> Clock 120 PSU 110	<u>FROM:</u> <i>B. Robertson</i> PROJECT LEADER
<u>ORDER CODE</u> AEH 14	<u>PART NUMBER</u> 012.001	<u>DEPTH (mm)</u> Clock 65 PSU 75	<u>MATERIAL</u> Plastic	<u>TO:</u> CUSTOMER SERVICES SALES ACCOUNTS R & D MANAGER CHIEF ENGINEER PRODUCT SERVICES GROUP LEADER
<u>FUNCTION</u> To provide a clock (at changeable frequency) for the Econet system		<u>COLOUR</u> Clock: Two-tone grey PSU: Black	<u>CONSTRUCTION</u> Moulded	
<u>OPERATES WITH (Peripherals)</u> Econet Network		<u>CONTROLS (Switches, pots., keyboards)</u> None		
<u>SIMILAR EQUIPMENT</u> Econet Terminator Box (AEH 15)		<u>INDICATORS (Meters, lamps, readouts, audible)</u> "Power On" LED on clock box		
<u>MAJOR COMPONENTS</u> Clock box containing oscillator and divider.		<u>SIGNAL CONNECTIONS (V,A,Z, Baudrates, frequencies, connector type)</u> 5-pin 180° DIN connector on clock box (standard Econet interface)		
<u>DESCRIPTION OF OPERATION</u> The clock, when connected to an Econet network (normally as close to the centre as possible), provides a reference clock signal for the network to synchronise all the machines connected. The clock rate is internally selectable in discrete steps between 4K8 and 460 KHz.		<u>POWER IN (V,A,W,Hz,Connector type)</u> 240v, 50Hz, 4 watts to PSU 8v (DC), 250mA to clock box		<u>POWER OUT (V,A,W,Hz, Connector Type)</u> None
		<u>APPROVALS (BS,FCC,CSA, UL,VDE,BEAB)</u> To conform to BS415 (79) Double insulated		<u>GUARANTEE</u> 6 months
		<u>OPERATING TEMPERATURE (°C)</u> 0-35°C		<u>WEIGHT (KG) UNIT ONLY</u> 1.5 <u>WEIGHT (KG) INC. PACKAGING & ACCESSORIES</u> 1.6
		<u>PACKAGING</u> Two part polystyrene Cardboard box		<u>ACCESSORIES INCLUDED</u> Econet cable Mains Adaptor
<u>CAPACITY</u> N/A	<u>FORMAT</u> N/A	<u>APPENDICES</u> None		
<u>SPEED (operating frequency)</u> Variable between 4.8 and 460KHz	<u>INSTALLATION</u> User	<u>DRAWING NUMBER</u> 012.001/E	<u>APPROVED FOR PRE-PRODUCTION RELEASE</u> <i>[Signature]</i> © COPYRIGHT 1983 ACORN COMPUTERS LTD.	

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<u>EQUIPMENT</u> ECONET TERMINATOR BOX		<u>HEIGHT (mm)</u> Terminator: 40 PSU: 60	<u>WIDTH (mm)</u> Terminator: 120 PSU: 110	<u>FROM:</u> <i>B. Robertson</i> PROJECT LEADER
<u>ORDER CODE</u> AEH 15	<u>PART NUMBER</u> 012,002	<u>DEPTH (mm)</u> Terminator: 65 PSU: 75	<u>MATERIAL</u> Plastic	<u>TO:</u> CUSTOMER SERVICES SALES ACCOUNTS R & D MANAGER CHIEF ENGINEER PRODUCT SERVICES GROUP LEADER
<u>FUNCTION</u> To provide termination for each end of an Econet network		<u>COLOUR</u> Terminator: Two-tone grey PSU: Black	<u>CONSTRUCTION</u> Moulded	
<u>OPERATES WITH (Peripherals)</u> Econet Network		<u>CONTROLS (Switches, pots., keyboards)</u> None		
<u>SIMILAR EQUIPMENT</u> Econet clock box (AEH 14)		<u>INDICATORS (Meters, lamps, readouts, audible)</u> "Power On" LED on terminator box		
<u>MAJOR COMPONENTS</u> Terminator Box containing termination and line bias voltage components		<u>SIGNAL CONNECTIONS (V,A,Z, Baudrates, frequencies, connector type)</u> 5-pin 180° DIN connector on terminator box (standard Econet Interface)		
<u>DESCRIPTION OF OPERATION</u> A resistor/capacitor/diode network within the terminator box holds the two "Data" lines at $\pm 0.25V$ around +2V, which drives the data lines at logic "1" when the line is idle. When the lines are in use the terminators prevent reflections.		<u>POWER IN (V,A,W,HZ, Connector type)</u> 240V, 50Hz, 4 watts to PSU 8V(DC), 250mA to terminator box		<u>POWER OUT (V,A,W,HZ, Connector Type)</u> None
		<u>APPROVALS (BS,FCC,CSA, UL,VDE,BEAB)</u> To conform to BS415 (79) double insulated		<u>GUARANTEE</u> 6 months
		<u>OPERATING TEMPERATURE (°C)</u> 0-35°C		<u>WEIGHT (KG) UNIT ONLY</u> 1.5
		<u>PACKAGING</u> Two-part polystyrene Cardboard box		<u>WEIGHT (KG) INC. PACKAGING & ACCESSORIES</u> 1.6
<u>CAPACITY</u> N/A	<u>FORMAT</u> N/A	<u>ACCESSORIES INCLUDED</u> Econet Cable Mains adaptor		
<u>SPEED (operating frequency)</u> N/A	<u>INSTALLATION</u> User	<u>DRAWING NUMBER</u> 012,002/E	<u>APPROVED FOR PRE-PRODUCTION RELEASE</u> <i>C. J. D.</i> CH. ENG.	
		<u>ISSUE</u> 1	<u>DATE</u> 4.83	<u>© COPYRIGHT 1983</u> ACORN COMPUTERS LTD.

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<u>EQUIPMENT</u> ECONET 10 STATION LEAD KIT		<u>HEIGHT (mm)</u> N/A	<u>WIDTH (mm)</u> N/A	<u>FROM:</u>  PROJECT LEADER
<u>ORDER CODE</u> AEH 18	<u>PART NUMBER</u> 012.016	<u>DEPTH (mm)</u> N/A	<u>MATERIAL</u> N/A	<u>TO:</u> CUSTOMER SERVICES SALES ACCOUNTS R & D MANAGER CHIEF ENGINEER PRODUCT SERVICES GROUP LEADER
<u>FUNCTION</u> Provide extra leads and Y pieces for Econet system users		<u>COLOUR</u> Black	<u>CONSTRUCTION</u> N/A	
<u>OPERATES WITH (Peripherals)</u> Any Econet product		<u>CONTROLS (Switches, pots., keyboards)</u> None		
<u>SIMILAR EQUIPMENT</u> 100m lead		<u>INDICATORS (Meters, lamps, readouts, audible)</u> None		
<u>MAJOR COMPONENTS</u> 10 leads (1 metre long) 11 3-way 'y' pieces		<u>SIGNAL CONNECTIONS (V,A,Z, Baudrates, frequencies, connector type)</u> 1 off 5-pin 180° DIN "Free" plug each end of leads 3 off 5-pin 180° DIN sockets per 'y' piece		
<u>DESCRIPTION OF OPERATION</u> N/A		<u>POWER IN (V,A,W,Hz,Connector type)</u> N/A	<u>POWER OUT (V,A,W,Hz,Connector Type)</u> N/A	
		<u>APPROVALS (BS,FCC,CSA, UL,VDE,BEAB)</u> None	<u>GUARANTEE</u> 6 months	
		<u>OPERATING TEMPERATURE (°C)</u> 0 to 35°C	<u>WEIGHT (KG) UNIT ONLY</u> 0.8	<u>WEIGHT (KG) INC. PACKAGING & ACCESSORIES</u> 0.9
<u>CAPACITY</u> N/A		<u>PACKAGING</u> Jiffy bag	<u>ACCESSORIES INCLUDED</u> Installation sheet	
<u>SPEED (operating frequency)</u> N/A		<u>INSTALLATION</u> By user	<u>APPROVED FOR PRE-PRODUCTION RELEASE</u>  CH. ENG.	
		<u>APPENDICES</u> None	<u>DRAWING NUMBER</u> 012,016/E	<u>ISSUE</u> 1
			<u>DATE</u> 2.83	<u>COPYRIGHT 1983</u> ACORN COMPUTERS LTD.

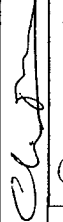
Alphabetic issues to be regarded as provisional information. Numeric issues are correct but as products are subject to improvement and modification, this specification may change without prior notice and no responsibility is

<u>EQUIPMENT</u> ECONET USER KIT		<u>HEIGHT (mm)</u> N/A	<u>WIDTH (mm)</u> N/A	<u>FROM:</u> PROJECT LEADER
<u>ORDER CODE</u> T.B.A	<u>PART NUMBER</u> 012,010	<u>DEPTH (mm)</u> N/A	<u>MATERIAL</u> N/A	<u>TO:</u> CUSTOMER SERVICES SALES ACCOUNTS R & D MANAGER CHIEF ENGINEER PRODUCT SERVICES GROUP LEADER MANUFACTURING
<u>FUNCTION</u> To provide operating details and connection ability to BBC Econet users.		<u>COLOUR</u> N/A	<u>CONSTRUCTION</u> N/A	
<u>OPERATES WITH (Peripherals)</u> BBC Microcomputer with Econet.		<u>CONTROLS</u> (Switches, pots., keyboards) N/A		
<u>SIMILAR EQUIPMENT</u> None.		<u>INDICATORS</u> (Meters, lamps, readouts, audible) N/A		
<u>MAJOR COMPONENTS</u> Econet lead. Econet User guide. Covering letter.		<u>SIGNAL CONNECTIONS</u> (V,A,Z, Baudrates, frequencies, connector type) N/A		
<u>DESCRIPTION OF OPERATION</u> N/A		<u>POWER IN</u> (V,A,W,HZ, Connector type) N/A	<u>POWER OUT</u> (V,A,W,HZ, Connector Type) N/A	
		<u>APPROVALS</u> (BS,FCC,CSA, UL,VDE,BEAB) N/A#	<u>GUARANTEE</u> N/A	
		<u>OPERATING TEMPERATURE</u> (°C) N/A	<u>WEIGHT (KG) UNIT ONLY</u> 0.1	
			<u>WEIGHT (KG) INC. PACKAGING & ACCESSORIES</u> 0.15	
<u>CAPACITY</u> N/A	<u>FORMAT</u> N/A	<u>PACKAGING</u> Cardboard stiffener Jiffy bag <u>ACCESSORIES INCLUDED</u> None		
<u>SPEED</u> (operating frequency) N/A	<u>INSTALLATION</u> N/A	<u>APPENDICES</u> None	<u>DRAWING NUMBER</u> 012,010/E <u>ISSUE</u> 1 <u>DATE</u> 2/83	<u>APPROVED FOR PRE-PRODUCTION RELEASE</u> CH. ENG. © COPYRIGHT 1983 ACORN COMPUTERS LTD.

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ACORN COMPUTERS LTD. ENGINEERING INFORMATION SHEET

4	5	7	1	July 83
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<u>EQUIPMENT</u> ECONET PRINTER SERVER EXPANSION		<u>HEIGHT (mm)</u> N/A	<u>WIDTH (mm)</u> N/A	<u>FROM:</u> 	<u>PROJECT LEADER</u>
<u>ORDER CODE</u> AES 22	<u>PART NUMBER</u> 012,014	<u>DEPTH (mm)</u> N/A	<u>MATERIAL</u> N/A	<u>TO:</u> CUSTOMER SERVICES SALES ACCOUNTS R & D MANAGER CHIEF ENGINEER PRODUCT SERVICES GROUP LEADER	
<u>FUNCTION</u> Econet system users share printer resource at Printer Server station		<u>COLOUR</u> N/A	<u>CONSTRUCTION</u> N/A		
<u>OPERATES WITH (Peripherals)</u> BBC Microcomputer models B + E and B + D + E with series or Parallel (centronics) printer attached		<u>CONTROLS (Switches, pots., keyboards)</u> None			
<u>SIMILAR EQUIPMENT</u> None		<u>INDICATORS (Meters, lamps, readouts, audible)</u> None			
<u>MAJOR COMPONENTS</u> 64k bit ROM or EPROM containing the Printer Server Program		<u>SIGNAL CONNECTIONS (V,A,Z, Baudrates, frequencies, connector type)</u> All provided by 28-pin sideways ROM socket in BBC computer			
<u>DESCRIPTION OF OPERATION</u> The printer server station receives and services print requests under interrupt using the "System Timer" Event. Printing is strictly on a first-come, first-served basis.		<u>POWER IN (V,A,W,HZ, Connector type)</u> Internal to BBC computer		<u>POWER OUT (V,A,W,HZ, Connector Type)</u> None	
		<u>APPROVALS (BS,FCC,CSA, UL,VDE,BEAB)</u> None		<u>GUARANTEE</u> 6 months	
		<u>OPERATING TEMPERATURE (°C)</u> 0 - 35°C		<u>WEIGHT (KG) UNIT ONLY</u> 0.1 <u>WEIGHT (KG) INC. PACKAGING & ACCESSORIES</u> 0.15	
<u>CAPACITY</u>	<u>FORMAT</u> "Sideways" ROM	<u>PACKAGING</u> Antistatic Foam Cardboard Stiffener Shrink Wrap		<u>ACCESSORIES INCLUDED</u> Introduction Sheet Manual (A5)	
<u>SPEED (operating frequency)</u> Max. 2,000 characters per second (dependent on printer)	<u>INSTALLATION</u> By user or authorised dealer	<u>APPENDICES</u> None		<u>DRAWING NUMBER</u> 012,014/E	
		<u>ISSUE</u> 1	<u>DATE</u> 4.83	<u>APPROVED FOR PRE-PRODUCTION RELEASE</u> 	<u>'CH. ENG.</u> © COPYRIGHT 1983 ACORN COMPUTERS LTD.

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5.8 THE ECONET SYSTEM USER GUIDE - ERRATA

p76 The transmission returns an 8 bit code on completion, the bottom five bits of which contain an error code.

<u>Returned Code</u>	<u>Error</u>
&40	Line Jammed
&41	Net Error
&42	Not Listening
&43	No Clock
&44	Bad TX Block

p81 The maximum size of parameter block for remote jumps and procedure calls is 128 bytes.

p83 The control flag for the Remote Procedure Call is misprinted and should read &85.

p89 a) 11.2.1 Calling TX

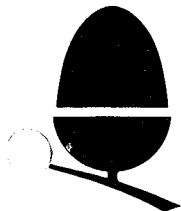
The user copy of the control block will have its control byte zeroed if TX cannot be initialised.

Otherwise the control block is copied to OS workspace and must be polled by the following call.

b) 11.2.2 Polling TX

On exit X contains the TX block control byte

0 = : successful TX 0 = : failed TX (see p76)



5.9 ECONET FAULT FINDING

This document is intended as a first level check list to enable users to detect a fault on a portable network e.g a network assembled for exhibition purposes. All the relevant procedures should be diligently followed before contacting Acorn Computers for advice.

Whilst carrying out the following procedures it would be useful to keep a record of that which you have checked and the faults, if any, that you have found. If, when all the checks have been carried out, you still have not resolved the fault, you should contact Acorn Customer Services on Cambridge (0223) 210111.

INDEX

1. LINE JAMMED
2. NET ERROR
3. NOT LISTENING
4. NO REPLY
5. NO CLOCK
6. MACHINE FAULTS
7. SETTING A STATION NUMBER
8. MINIMUM NETWORK CONFIGURATION
9. CHECK LIST

In the event of a fault occurring with your network, it would be appreciated if you would complete the check list at the back of this document. Please return the completed form to :

Acorn Computers Ltd.
Customer Services Dept.
Cambridge Technopark.
Newmarket Road
Cambridge.

1. LINE JAMMED

This error is returned if there is continuous information on the data lines. This may be due to a fault in another station or in one (or both) of the terminators.

If this fault is reported then do the following, checking at each stage to see if the fault has been rectified.

(1) Check that there are not two stations on the network with the same number. If there are two or more stations with the same number

the numbers must be changed. To do this refer to section 7 of this leaflet.

(2) Reset all stations connected to the network and restart the file server and print server.

(3) Unplug all stations from the network with the exception of one user station and the file server. Restart the file server and reset the user station and try to access the file server, if this is successful then you should replace all the other stations one at a time re-trying at every stage until the faulty machine is located.

(4) If at the beginning of stage (3) you get a line jammed message reported with only the one machine and the file server connected to the network then exchange the user station and re-try. If this is successful then continue as explained in stage (3).

(5) There may be a faulty terminator connected to the network, if you have spare terminators then exchange them one at a time for the terminators already in use. If however you do not have replacements then you should remove one terminator and re-try the system, then reconnect that terminator and remove the other one. If one of the terminators is causing the problem and you do not have a replacement it is possible to run a network of up to ten stations with only one terminator, however a replacement should be obtained as soon as possible.

(6) A line jammed error will be reported if there are crossed wires in the network. At this point you should refer to the section concerning the error message "NET ERROR" and follow stage (4).

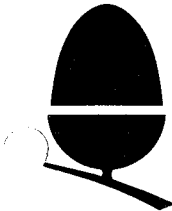
2. NET ERROR

This error is returned if an error occurs during transmission. It may be due to an unsuitable clock speed for the network, a fault in the terminators or a fault in the network cable.

(1) If two or more station numbers on the network are the same then it may well produce this error. If this is the case then refer to section 7 of this leaflet.

(2) To determine whether the clock speed is suitable you should refer to section 8.3 in the Econet System User Guide. It should be noted that although the BBC machine is capable of a network speed of 307k the use of a plug together lead set will reduce this in practice to 230k.

(3) Check the terminators to see if they are (a) connected to a power supply and that the power supply is switched on (check the LEDs on the terminators). (b) That the terminators are connected to



the network.

(4) The most common cause of a NET ERROR message is a fault in the cable, either a short circuit, open circuit or crossed wires. To determine whether this is the case it is necessary to check each of the leads and junction pieces. To do this you should shorten the network to the bare minimum of seven leads and three junctions. Connect onto this the clock box to the central junction, the file server and one terminator to one end and a user station and the other terminator to the other end. Restart the file server and reset the user station and try to access the file server. If this is unsuccessful then replace the leads and junctions one at a time re-trying each time until the faulty lead or junction is isolated. When the network functions correctly at the minimum length, rebuild the network connecting one junction piece, two leads and a user station at each stage. Each time you connect another station you must re-try the network to ensure that you do not introduce other faulty leads or junctions. Section 8 contains a diagram of a minimum configuration network.

IT IS MOST IMPORTANT TO ENSURE THAT ALL LEADS AND JUNCTIONS ARE EXCHANGED DURING THIS OPERATION. DO NOT OVERLOOK ANY POSSIBLE LEADS OR JUNCTIONS BY RUSHING THROUGH THE ABOVE CHECKING.

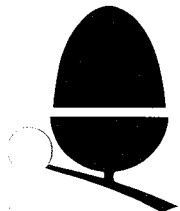
3. NOT LISTENING

This message may occur when any Network Filing System command is executed, and means either that the machine to which the command is directed is not attached to the network, or is not interested. For example, trying to save a file on a network without a file server, or when the file server program is not running, will produce the Not Listening message. Similarly, the message will appear if you try to VIEW a non-existent or protected station.

(1) If upon trying to access either the file server or the print server you get the message Not Listening you should check that the peripheral has been initialised (started up) and that the unit is connected to the Network. If you are in any doubt at all you should always re-start.

(2) When you are sure that the File/Print server has been correctly started you should try to access the unit again. If you are still unsuccessful you should ascertain whether the File/Print server has the correct station number. The default number for the File Server is 254 and the number for the Print Server is 235. If the number differs from these you should change the station number as detailed in the Econet System User Guide page 69.

(3) If all of the above is correct then you should change the lead that connects the peripheral to the network as this may be at fault. If having changed the lead and relevant junction piece you should suspect either the remote station i.e the File Server or the



user station which is being denied access.

(4) It should be noted that the station that you are trying to access should be in the Econet mode. If for example you are trying to access a station that has an acoustic coupler attached, it must have the NFS selected as it's current filing system. If this is not the case then typing *NET will put the machine into the correct mode.

4. NO REPLY

This message is less likely to occur and generally means that some operation has failed in the middle. For example, if a user types LOAD "FILE" and at that moment the disc is removed from the File Server, or the File Server is disabled in some way, it is likely that the NO REPLY message will occur.

(1) You should physically check that the peripheral is still attached to the network and that it is still enabled e.g make sure the printer is still switched on. Ensure that the printer still has paper, ribbon etc. or in the case of a disc that the drive door is shut and the disc correctly inserted.

(2) If all appears to be well then you should re-try and if you are still unsuccessful you will probably receive a different error message at which point you should follow the relevant procedure.

5. NO CLOCK

This message is returned if the Econet interface in the user station cannot detect a valid clock signal. After checking that you are plugged into the network, the problem will probably lie in the clock box or in the clock lines of the cable.

(1) Firstly check that your terminal is in fact plugged into the network.

(2) Check that the clock box is connected to the network and is connected to a power supply (ensuring that the LED indicator on the clock box is lit).

(3) Assuming that it is only one user station that has received the NO CLOCK message you should change the cable connecting the machine to the network and also exchange the junction piece at that point in the network. If this does not solve the problem then it is almost certainly the user station itself which is at fault.

(4) In the instance whereby all the user stations are receiving a NO CLOCK message and you have completed the checks in sections (1)

and (2) you should if possible exchange the clock box. If however this is not possible then you should check that there is an output from the clock box, unfortunately you will need either an oscilloscope or an Acorn Econet test box. If one of these is not available it would be advantageous to try step (5) as it may be a fault in the clock line.

(5) Using a standard test meter you should test the continuity in the clock lines. These should be found on pins 3 and 5. of the network bus (refer to page 67 in the Econet System User Guide. If there is a break in the continuity you should remove each lead and junction piece one at a time until the faulty lead or junction is located.

6. MACHINE FAULTS

If during the preceeding checks you have discovered a faulty machine it may be the case that the machine is incorrectly configured. In the event that you are short of equipment and a replacement machine is not available it may be possible to locate the problem with a visual check. Ensure that the machine is unplugged and remove the lid. You should now check the following:

(1) Check that there is in fact an Econet interface in the machine. On the bottom left hand corner of the main printed circuit board you will find a row of five sockets some of which will contain chips. Ensure that one of these chips is labelled NFS 3.34 (the number may vary), Also check that the top left hand corner of the board is populated, in particular that IC 89 is present.

(2) Check that link S2 is cut, you will find this on the left hand edge of the main PCB.

(3) Locate link S9 which is to be found slightly below and to the left of the words ACORN COMPUTERS. This link should be made if IC 78 (located directly below the words ACORN COMPUTERS) is NOT present. The link should be cut if IC 78 IS present.

(4) For the pupose of this section North is taken to mean the back of the machine and South is the front of the machine under the keyboard.

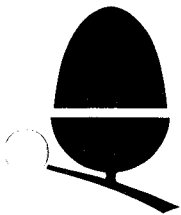
You should now also check the following links, although they should have been set correctly during production. The term OPEN means that NO CONNECTION IS MADE across the link. If a compass bearing is indicated it implies a three pin link running either north to south or east to west. Therefore to set a link NORTH the connector should be placed across the top and middle link of three vertical pins.

The links should be set as follows:

-S5 SOUTH

- S12 OPEN
- S13 OPEN
- S18 NORTH
- S19 EAST
- S20 NORTH
- S21 2 x EAST-WEST
- S22 NORTH
- S32 WEST
- S33 WEST

When all the above checks have been completed and assuming no alterations have been made the machine should be reassembled and if the machine still fails to function correctly you should consult an Acorn technician.



7.SETTING A STATION IDENTITY

To set the station number
you should locate S11.
of which this diagram is
an exploded view.

STATION NUMBER 219

1.	0 0
2.	0 0
4.	
8.	0 0
16.	0 0
32.	
64.	0 0
128.	0 0

NORTH.



When the connector is placed across the pins the number is inoperative.
Therefore the station identity shown here is;

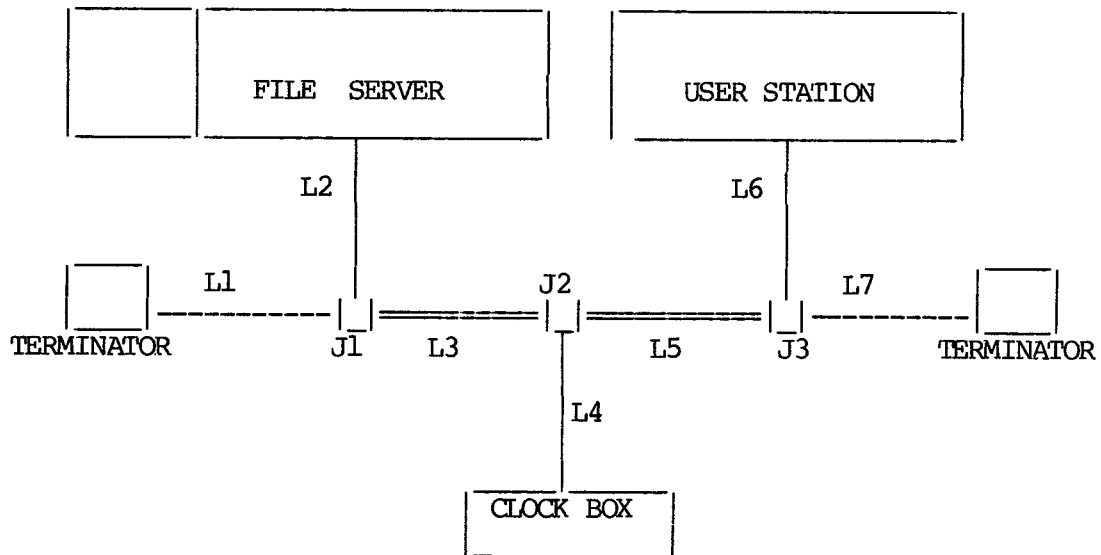
$$1+2+8+16+64+128 = 219$$

If you required station number 1 then all the connectors except the top one should be in place, if 254 is the required number then only the top link would be in place.

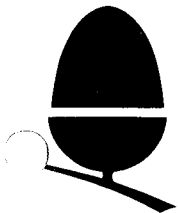
8. MINIMUM NETWORK CONFIGURATION

L(n)=Five pin din lead

J(n)=Junction piece

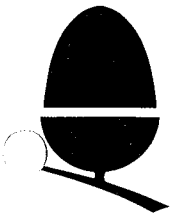


This is the configuration which you should start with when you commence stage 4 of the section on NET ERROR.



9.CHECK LIST

ERROR REPORTED	EQUIPMENT IN WHICH FAULT WAS FOUND
LINE JAMMED	
NET ERROR	
NOT LISTENING	
NO REPLY	
NO CLOCK	
MACHINE FAULT	
OTHER	
COMMENTS	



5.10 SYSTEM 5 MODIFICATIONS

CONTENTS

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4.5.10.1	CONTENTS
4.5.10.2	INTRODUCTION / REASONS FOR MODIFICATIONS
4.5.10.3	FITTING MAINS FILTER
4.5.10.4	DIAGRAM OF MAINS FILTER INSTALLATION
4.5.10.5	MODIFICATIONS TO CPU CARD (200,005)
4.5.10.6	WIRING OF 74HC244 ON CPU CARD (200,005)
4.5.10.7	MODIFICATIONS TO 32K DRAM CARD (200,010)
	COMPONENTS LIST
4.5.10.8	DIAGRAM OF 32K DRAM MODIFICATIONS (200,010)

INTRODUCTION

A field change order was raised to inform customer services of a possible problem with a number of system 5 computers. The following pages, for your information, show the letter that was sent to our customers in an attempt to trace the systems that were affected, and details of the necessary modifications.

Letter Sent to Customers

13 February 1984

Dear Sir

Our records indicate that you may have a System 5 supplied by Acorn Computers. It has been brought to our attention that a problem has arisen in certain system 5's delivered between May and August 1983. The system may exhibit the following symptoms:

- * The file server may stop occasionally and will not respond to keyboard input.
- * Stations on the network may receive the message "not listening".

It is possible that these symptoms occur separately under normal operation. If however, the symptoms occur simultaneously and persist, it may be necessary to return the System 5 for a service.

If you are experiencing problems such as these, could you please complete the attached form and return it to the address indicated as soon as possible, and not later than Friday 9 March. We will then contact you to make the necessary arrangements for the servicing of your equipment. Acorn will cover the transportation costs for the equipment to be returned to an appointed service agency, and we will of course make our best efforts to reduce the turn-around time, in order to minimise the disruption to your normal operation.

Yours faithfully
ACORN COMPUTERS LTD

FITTING THE MAINS FILTER

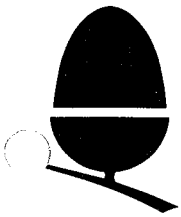
- (1) Turn off the System 5 and disconnect from the mains power supply.
- (2) Remove the top and back panels from the System 5 and remove the power supply.
- (3) Attach the mains filter to the cover of the power supply using two No.6 x 1/4" self tapping screws into the cooling holes (see the diagram on page 4.5.10.4)
- (4) Disconnect the mains connector from the power supply and desolder and remove the earth connection.
- (5) Remove the plastic connector from the mains cable and solder the Live, Neutral and Earth leads to the bottom end of the mains filter.
- (6) Connect and earth lead from the earth on the bottom of the mains filter to the earth connection on the power supply.
- (7) Connect the output of the mains filter to the power supply using the original plastic connector with new inserts.
- (8) Refit the power supply into the System 5 ensuring that it is orientated so that the connectors are on the left when the System is viewed from the front.

IMPORTANT NOTE: ALL MAINS CONNECTIONS AND CABLING MUST BE SLEEVED AND THOROUGHLY INSULATED TO PREVENT DANGER FROM ELECTRIC SHOCK.

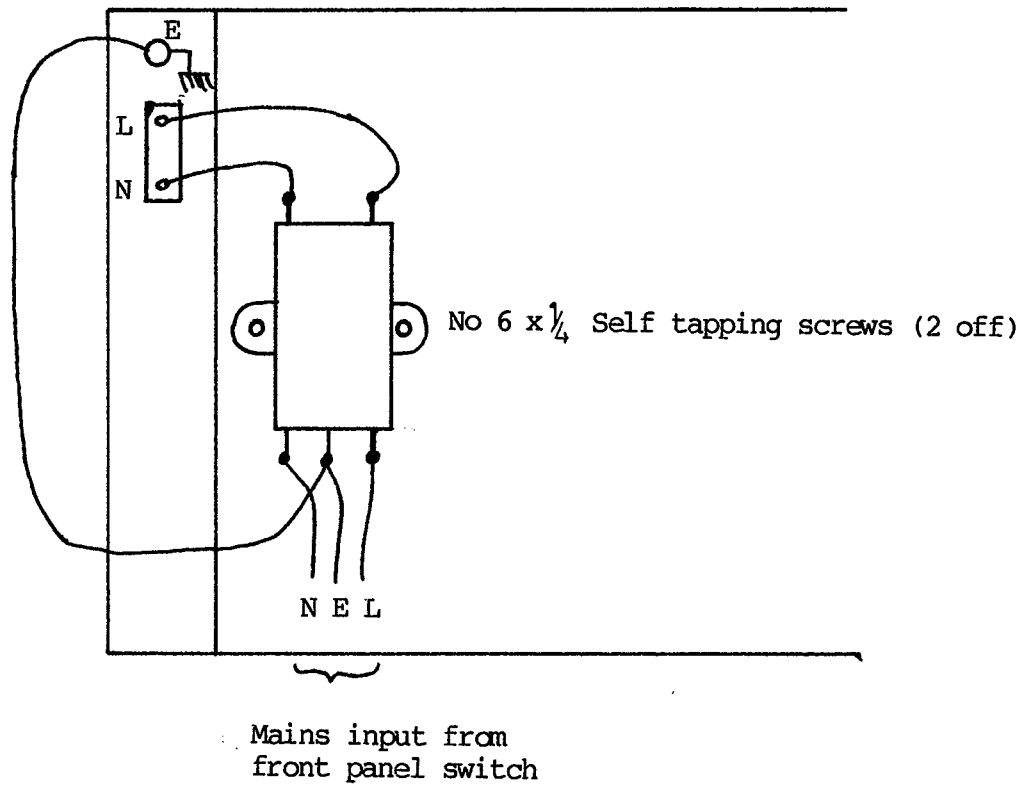
If preferred, for units already in the field or held in stock, a filter of similar characteristics may be supplied. This shall either be of the type built-in to a 3 pin 13 amp socket (requiring the replacement of the System 5 mains plug) or of the type supplied as a unit with a standard 13 amp socket (into which you plug the System 5) and a 3 pin 13 amp plug to connect the mains filter to a standard U.K power source.

A suggested source of the "built-in" type is the MPL Clean Power Plug (6 amp rating). this is available from:

MPL Power Systems Ltd.
Bilton Way,
Hayes,
Middlesex,
UB3 3ND



Mains filter installation



All wires 32/0,2

N Blue

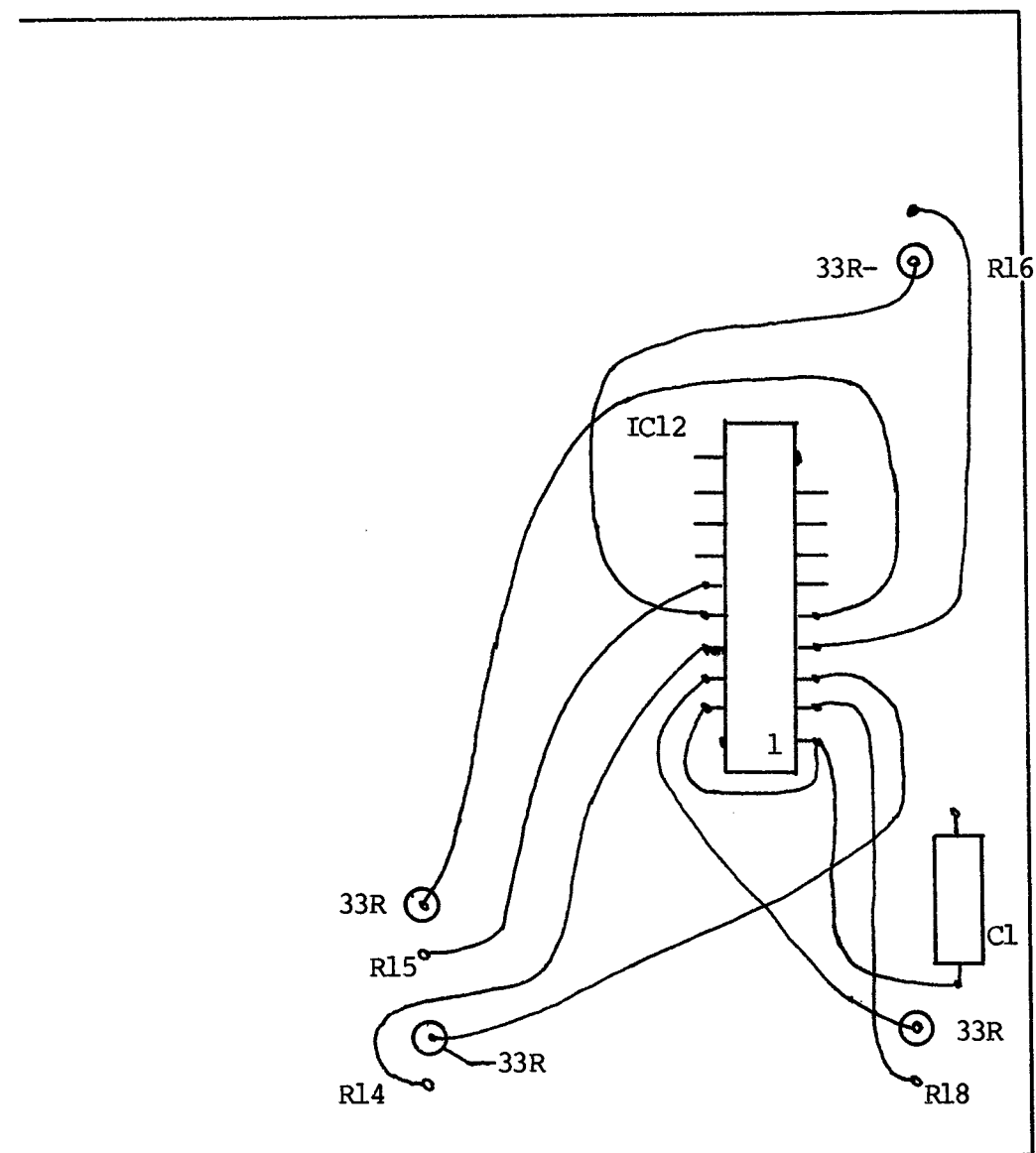
L Brown

E Green/Yellow

MODIFICATIONS TO CPU CARD (200,005)

- (1) Remove the CPU card from the System 5 (the card with the 20 way socket)
- (2) Locate and remove I.C. 12 (741S245N)
- (3) Take I.C. 74HC244 and bend all the pins except 10 and 20 horizontal.
- (4) Fit I.C 74HC244 into I.C. 12 by soldering pins 10 and 20.
- (5) Locate and remove resistors: R14, R15, R16 and R18.
- (6) Insert one end of each 33R resistor vertically into positions R14, R15, R16 and R18 (as shown in the diagram on page 4.5.10.6) leaving the other end free.
- (7) Wire up the 74HC244 as shown in the diagram on page 4.5.10.6.
- (8) Cut unused legs on the 74HC244 flush with the packaging.
- (9) Turn the board over and solder a 47nF disc ceramic capacitor (12v working or greater) between pins 10 and 20 on I.C. 12. Insulate the leadout wires and lay the component flat against the PCB with the top towards the edge connector.

Wiring of 74HC244 on CPU card (200,005)



MODIFICATIONS TO 32K DRAM CARDS (2000,010)

Please note that there are two of these cards in the System 5 both of which must be modified as follows:

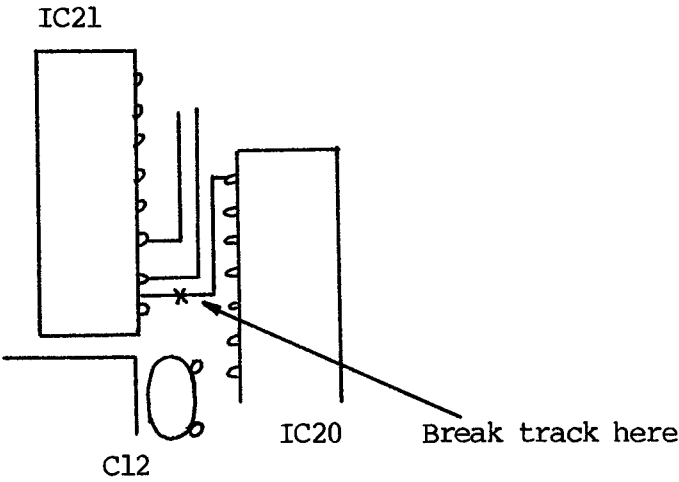
- (1) Replace I.C.27 (74LS74) with I.C. 74HC74
- (2) Cut the track from that runs from I.C.20 pin 1 to I.C.21 pin 3 (see the diagram on next page).
- (3) Fit a wire link from I.C.20 pin 1 to I.C.21 pin 6 on the reverse side of the board.

COMPONENTS LIST QUANTITIES ARE PER SYSTEM

ITEM	ACORN PART No.	DESCRIPTION	No. OFF	COMMENTS
1	831,900	MAINS FILTER	1	
2	747,244	I.C. 74HC244	1	
3	747,074	I.C. 74HC74	2	
4	502,330	RESISTOR 33R 1/4W 5%	4	
5	628,470	CAPACITOR 47nF DISC CERAMIC	1	
6	870,151	WIRE 32/0.2mm BLUE	A/R	)
7	870,152	WIRE 32/0.2mm BROWN	A/R	) FOR MAINS RE-WIRING
8	870,153	WIRE 32/0.2mm GREEN/YELLOW	A/R	)
9	870,160	WIRE 1/0.6mm BLACK	A/R	FOR P.C.B LINKS
10	800,090	CRIMP CONNECTOR INSERTS	2	
11	880,040	SLEEVEING	A/R	FOR ITEMS 5,6,7 AND 8

If item 1 is replaced by the external-type mains filter (831,910) then items 1, 6, 7, 8, 10 and part of 11 are not required.

Diagram of DRAM modifications (200,010)



TESTING THE SYSTEM 5

The System 5, once modified, should be subjected to the following test procedure. The equipment needed to carry out the test is:

- (i) The unit under test
- (ii) Continuity/ short circuit detector (eg Hytrack)
- (iii) "System 5 Test Procedure" Discette (2 off)
- (iv) A formatted blank System 5 discette
- (v) Monitor
- (vi) ASCII keyboard

Test Procedure

PLEASE NOTE: Whenever equipment is connected to or disconnected from the System 5 the power must be turned OFF.

Should the System 5 itself or any of its component parts fail a test at any stage, the test procedure should be started at the beginning following repair of the unit.

1. Rack/ PSU Tests

Take the assembled rack and, using the continuity/ short circuit detector, check continuity between earth pin on mains plug and all exposed metal parts of case.

2. Complete System Test

(a) Put all the cards into the system and turn on. If the system fails to work, test the cards by plugging them one-by-one into a known working System 5.

(b) Insert the disc entitled "System 5F Test Procedure" into left hand drive (drive 0). If the System 5 auto-boots (ie drive light is on and system attempts to read the disc), press <Delete> followed by <Break> to produce the prompt :

Acorn Dos

*

(c) Type CRC <Return>

Enter the following in response to prompts:

Start address? E000 <Return>
End address? 0000 <Return>

The correct result is 7906. Any deviation from this indicates a faulty EPROM on the CPU card.

(d) Type the following:

```
ATBASIC <Return>
LOAD "KYBD" <Return>
RUN <Return>
```

Follow the instructions displayed on the screen to test the keyboard. Any keys which are faulty will fail to erase the corresponding symbol from the screen

(e) Type LOAD "CPURAM" <Return>
RUN <Return>

This tests the CPU page 0 RAM from 0400 to 07FF. If this test indicates failure, check that LK5 is present and LK6 is absent and retest if appropriate.

(f) Type LOAD "RANRAM" <Return>
RUN <Return>

This exhaustive test of blocks 4,6,8 and A of RAM takes approximately 1 minute. Block 2 contains the test program and Block C contains ATBASIC so these areas cannot be written to by a test program. However, the fact that the program runs proves these areas.

(g) Type LOAD "VDURAM" <Return>
RUN <Return>

This tests the VDU RAM.

3. Disc Tests

Insert the formatted blank System 5 disc into drive 1 .

Type <Delete> <Break>
E.READ <Return>

This test should take in the region of 4 minutes 10 seconds and verifies all four surfaces of the disc drives.

Type <Delete> <Break>
E.WRT <Return>

This test also takes in the region of 4 minutes 10 seconds, and ensures the four surfaces of the disc drive can be written to; the tests in this and the previous section also exercise the FDC card.

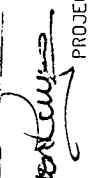
PLEASE NOTE: If the power fails, or the system is turned off during this test, there is a slight possibility that the disc

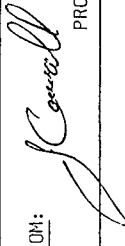
may become corrupted, producing "Disc Errors" when it is next read. If this should happen, revert to a backup copy.

4. Econet

Where the System 5 is to be used as a file server, then it should be tested for operation by starting it as a file server and ensuring it can be accessed by all users on the network. If this, fails, the Econet card may be tested by inserting it into a known working System 5 file server.

This completes the test procedures

<u>EQUIPMENT</u> TELETEXT ADAPTOR		<u>HEIGHT (mm)</u> 70	<u>WIDTH (mm)</u> 210	<u>FROM:</u>  PROJECT LEADER
<u>ORDER CODE</u> ANE 01	<u>PART NUMBER</u> 004,000	<u>DEPTH (mm)</u> 350	<u>MATERIAL</u> ABS injection moulded plastic	<u>TO:</u> CUSTOMER SERVICES SALES ACCOUNTS R & D MANAGER CHIEF ENGINEER PRODUCT SERVICES GROUP LEADER
<u>FUNCTION</u> Provides access to teletext and telesoftware services broadcast on U.H.F. channels E21 to E69		<u>COLOUR</u> BBC computer cream	<u>CONSTRUCTION</u> Moulded top and bottom to match BBC computer profile	
<u>OPERATES WITH (Peripherals)</u> Any Model "B" BBC Microcomputer with 1.2 M.O.S. or later issue		<u>CONTROLS</u> (Switches, pots., keyboards) Four tuning potentiometers on rear panel Mains on/off switch on rear panel		
<u>SIMILAR EQUIPMENT</u> None		<u>INDICATORS</u> (Meters, lamps, readouts, audible) None		
<u>MAJOR COMPONENTS</u> PCB carrying TV tuner, teletext acquisition circuitry and digital computer interface. Internal Power Supply.		<u>SIGNAL CONNECTIONS</u> (V,A,Z, Baudrates, frequencies, connector type) 34-way ribbon cable to BBC Microcomputer "1MHz Bus" Standard U.H.F. TV aerial socket		
<u>DESCRIPTION OF OPERATION</u> A 4-channel I.V. tuner demodulates incoming U.H.F. signals from a standard U.H.F. aerial and feeds a composite video signal to a Mullard video processor I.C. Teletext data is stored in on-board Random Access Memory and retrieved by the BBC Microcomputer during picture lines of the incoming video signal. All data processing is performed by a "Telerom" which is supplied and fitted within the BBC Microcomputer.		<u>POWER IN</u> (V,A,W,Iz, Connector type) 240v, 50Hz, 15w Moulded 13A fused plug on 2m cable		<u>POWER OUT</u> (V,A,W,Hz, Connector Type) None
<u>CAPACITY</u> 1 Kbyte on-board R.A.M.		<u>APPROVALS</u> (BS,FC,CSA, UL,VDE,BEAB) BS415 Class 1 applied for		<u>GUARANTEE</u> 6 months
<u>SPEED (operating frequency)</u> Max. data capture rate approx. 128 kbaud. (8 lines of Teletext per frame)		<u>OPERATING TEMPERATURE</u> (°C) 10 to 35°C		<u>WEIGHT (KG) UNIT ONLY</u> 2.0 <u>WEIGHT (KG) INC. PACKAGING & ACCESSORIES</u> 2.2
<u>FORMAT</u> See Appendix		<u>PACKAGING</u> Two part moulded polystyrene package contained in cardboard sleeve		<u>ACCESSORIES INCLUDED</u> User Manual "Telerom"
<u>INSTALLATION</u> Should be installed by a dealer as ROM and possible M.O.S. update required for BBC Micro.		<u>APPENDICES</u> 1. Teletext data format and broadcast specification		<u>APPROVED FOR PRE-PRODUCTION RELEASE</u>  CH. ENG.
		<u>DRAWING NUMBER</u> 004,000/E	<u>ISSUE</u> 1	<u>DATE</u> 10.82
				<u>DATE</u> 10.82
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<u>EQUIPMENT</u> SECOND PROCESSOR - 6502		<u>HEIGHT (mm)</u> 70	<u>WIDTH (mm)</u> 210	<u>FROM:</u>  PROJECT LEADER
<u>ORDER CODE</u> ANC 01	<u>PART NUMBER</u> 008,000	<u>DEPTH (mm)</u> 350	<u>MATERIAL</u> ABS injection moulded plastic	<u>TO:</u> CUSTOMER SERVICES SALES ACCOUNTS R & D MANAGER CHIEF ENGINEER PRODUCT SERVICES GROUP LEADER
<u>FUNCTION</u> Provide extra processing power, i.e. faster operation of programs and more user memory for the BBC Microcomputer.		<u>COLOUR</u> BBC computer cream	<u>CONSTRUCTION</u> Moulded top and bottom to match BBC computer profile	
<u>OPERATES WITH (Peripherals)</u> BBC Microcomputer Model B with Econet/tube ROM fitted		<u>CONTROLS (Switches, pots., keyboards)</u> None		
<u>SIMILAR EQUIPMENT</u> Second Processor - 280 ANC 02		<u>INDICATORS (Meters, lamps, readouts, audible)</u> None		
<u>MAJOR COMPONENTS</u> Plastic case, internal power supply. Fitted tube connector cable. PCB carrying: Tube ULA, 6502C, 8 x 64k DRAMs, Bootstrap ROM and other components.		<u>SIGNAL CONNECTIONS (V,A,Z, Baudrates, frequencies, connector type)</u> 40 way flat ribbon cable to BBC Microcomputer tube connector.		
<u>DESCRIPTION OF OPERATION</u> Once installed, the selected language is automatically passed across the tube into the second processor memory space. The second processor then carries out all user program language processing tasks. The original BBC computer processor then serves the language processor via the tube for all operating system functions. The second processors will run without a language ROM in the BBC computer, in which case the language may be loaded over the filing system at the users command.		<u>POWER IN (V,A,W,HZ, Connector type)</u> 240v AC 50Hz		<u>POWER OUT (V,A,W,HZ, Connector Type)</u> None
		<u>APPROVALS (BS,FCC,CSA, UL,VDE,IEC)</u> None To component BS4141/79		<u>GUARANTEE</u> 6 months
		<u>OPERATING TEMPERATURE (°C)</u> 10° - 35°C		<u>WEIGHT (KG) UNIT ONLY</u> 3.1
		<u>PACKAGING</u> Two part polystyrene in cardboard carton		<u>WEIGHT (KG) INC. PACKAGING & ACCESSORIES</u> 3.4
				<u>ACCESSORIES INCLUDED</u> User Manual Econet/Tube ROM
<u>CAPACITY</u> 64k total. 2½k for boot-strap ROM and work space. General 60k of RAM is available for the user program and the selected language.		<u>APPENDICES</u> None		<u>APPROVED FOR PRE-PRODUCTION RELEASE</u>  83
<u>SPEED (operating frequency)</u> 3MHz Clock 6502. Bus speed 3 Mbytes/second		<u>DRAWING NUMBER</u> 008,000/E		<u>ISSUE</u> 1
		<u>INSTALLATION</u> By dealer or user plug in. Note: ROM to be fitted in BBC computer		<u>DATE</u> 4.83

Alphabetic issues to be regarded as provisional information. Numeric issues are correct but as products are subject to improvement and modification, this specification may change without prior notice and no responsibility is accepted for any errors or omissions.

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EQUIPMENT PRESTEL ADAPTOR		HEIGHT (mm) 70	WIDTH (mm) 210	FROM: <i>Shonky</i> PROJECT LEADER
ORDER CODE ANE 02	PART NUMBER 015,000	DEPTH (mm) 350	MATERIAL ABS Injection moulded plastic	TO: CUSTOMER SERVICES SALES ACCOUNTS R & D MANAGER CHIEF ENGINEER PRODUCT SERVICES GROUP LEADER
FUNCTION Interfaces a BBC Microcomputer to any British Telecom attached 1200/75 baud dial-up system (e.g. Prestel, Micronet, Telecom Gold).		COLOUR BBC Computer cream Brown label	CONSTRUCTION Moulded top and bottom to match BBC Microcomputer profile	
OPERATES WITH (Peripherals) Any BBC Microcomputer Model "B" with 1.2 MDS or later issue.		CONTROLS (Switches, pots., keyboards) Mains on/off switch on rear panel		
SIMILAR EQUIPMENT Teletext Adaptor (ANE 01)		INDICATORS (Meters, lamps, readouts, audible) Loudspeaker monitor during call set-up		
MAJOR COMPONENTS Two part plastic box containing PCB carrying modem, auto-dialler, RS232 interface, 'phone line interface and power supply. Metal access prevention plate carrying loudspeaker assembly.		SIGNAL CONNECTIONS (V,A,Z, Baudrates, frequencies, connector type) Cable to 5-pin domino plug (RS423 interface) Cable to new telephone jack (telephone connection)		
DESCRIPTION OF OPERATION Call setup and auto-dialler fully computer controlled. A 1200/75 baud modem interfaces to the RS423 serial port on the BBC Microcomputer and to the telephone line via the telephone line barrier. All data processing is performed by software including the downloading of telesoftware files from Micronet 800.		POWER IN (V,A,W,HZ, Connector type) 240v, 50Hz, 10w 13a moulded plug		POWER OUT (V,A,W,HZ, Connector Type) None
		APPROVALS (BS,FCC,CSA, UL,VDE,BEAB) British Telecom applied for. Complies with BS415 Class 1		GUARANTEE 6 months
		OPERATING TEMPERATURE (°C) 10° - 35°C		WEIGHT (KG) UNIT ONLY 1.5 WEIGHT (KG) INC. PACKAGING & ACCESSORIES 1.7
CAPACITY N/A		PACKAGING Two-part moulded polystyrene contained within cardboard sleeve		
SPEED (operating frequency) 1200 baud receive 75 baud transmit		ACCESSORIES INCLUDED User Guide Prestel Filing System (PFS) ROM		
INSTALLATION By dealer as ROM and possible MOS update required within BBC Microcomputer		DRAWING NUMBER 015,000/E		
		APPENDICES None		
		APPROVED FOR PRE-PRODUCTION RELEASE CH. ENG.		
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